THE

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## ELECTRICAL REVIEW.

Vol. LXVII.] CONTENTS: September 30, 1910. [No. 1,714.

| | Page |
|---|---|
| The Relation of Science to Industry and Commerce ... ... | 521 |
| Copper ... ... ... ... ... ... ... ... | 522 |
| The Municipal Tramways Conference ... ... ... | 523 |
| Tramways in Relation to Town Planning ... ... ... | 524 |
| Correspondence :— | |
| The Association of Mining Electrical Engineers ... ... | 526 |
| Overcrowding in the Ranks of Central Station Officials... | 526 |
| Lightning Conductors ... ... ... ... ... | 527 |
| Coal-cutting Machinery and Electrical Accidents in Mines | 527 |
| Calculation of Illumination ... ... ... ... ... | 527 |
| Electricity in a Laundry ... ... ... ... ... | 527 |
| Electricians' Employment Bureau ... ... ... ... | 527 |
| Legal ... ... ... ... ... ... ... ... | 528 |
| New Electrical Devices, Fittings and Plant (*illus.*) ... ... | 528 |
| Business Notes ... ... ... ... ... ... ... | 533 |
| Electric Haulage in Collieries and Mines (*illus.*) ... ... | 539 |
| Power for Foundry Equipment ... ... ... ... ... | 543 |
| Notes ... ... ... ... ... ... ... ... ... | 546 |
| City Notes ... ... ... ... ... ... ... ... | 548 |
| Market Quotations ... ... ... ... ... ... ... | 550 |
| Stocks and Shares ... ... ... ... ... ... ... | 550 |
| Share List of Electrical Companies ... ... ... ... | 551 |
| Exports and Imports of Electrical Goods during Aug., 1910 ... | 553 |
| Electric Driving in Textile Mills (*illus.*) (*concluded*) ... ... | 554 |
| The British Association Meeting at Sheffield :— | |
| Positive Electricity ... ... ... ... ... ... | 557 |
| The Brighton Railway Electrification ... ... ... | 557 |
| The Principles of Mechanical Flight ... ... ... | 557 |
| Brussels Exhibition (*illus.*) (*continued*) ... ... ... ... | 558 |
| Trade Statistics of Newfoundland ... ... ... ... | 559 |
| New Patents Applied For, 1910 ... ... ... ... ... | 560 |
| Abstracts of Published Specifications ... ... ... ... | 560 |
| Contractors' Column ... ... Advertisement pages xxii and xxiv | |

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## THE RELATION OF SCIENCE TO INDUSTRY AND COMMERCE.

THE best methods of training students in science, so as to fit them for posts in the technical world, the failure of the British manufacturer to take full advantage of scientific assistance, and the possibility of bringing about a happier state of affairs, are subjects which have repeatedly claimed the attention of the British Association, and especially of Section B, the rallying point of the chemists. At this year's meeting in Sheffield, the whole question was brought up once more in a paper with which Mr. R. Blair opened a joint discussion held by Section B (Chemistry) and Section L (Education).

In a most interesting manner, Mr. Blair recounted the replies which he had received to a number of inquiries made of heads of Government departments, manufacturers, business men, distinguished men of science, students, and British Consuls abroad.

We may be permitted to offer some remarks on a few of the points raised by the paper and during the discussion which followed.

There can be no doubt that the relations of science to industry and commerce have been greatly improved by the movement in favour of the co-ordination of University and technical training, and at the same time there has been a considerable growth of sympathy on the part of the market for educational institutions and their products. The evidence shows that there has been a great increase in the number of technically-trained young men employed, especially in the engineering and metallurgical industries, and some educational institutions state that they have little difficulty in placing at least their best students. On the other hand, it is complained that, taken as a whole, only a small percentage of the students trained in this country find posts in the industrial world, and that many of the posts offered do not carry a sufficient salary to recompense the student for the time and money spent on his training. It is suggested that the manufacturer does not realise that the higher salary required by the trained man will, in all probability, be more than saved by the economies resulting from the application of scientific methods to his business.

Outside of the metallurgical industries, matters do not seem to have improved much, if at all, in the chemical world. The loss to this country of the colour industry has been referred to almost *ad nauseam*, but the British chemical manufacturer does not seem yet to have learnt the lesson. He is deaf alike to argument and to appeal.

Protests are made that the manufacturer knows his own business, and that he is tired of being scolded by the professors. If his business is to let valuable trade slip from his fingers, the replies from the Consuls bear out that he knows it well. The sending abroad of commercial travellers who

speak only English, armed with catalogues in English, with English weights, measures, and coinage, is only another phase of the British manufacturer's disregard of science. Consider together with these facts reported by our Consuls, the fact that when a pure chemist is employed by a manufacturer in this country, it is long odds that the manufacturer bears a foreign name.

Not only does the British manufacturer not believe in the application of pure science to industrial processes, but, as was pointed out during the discussion, when he does experiment in the matter, he expects too immediate results from the appointment. It is absurd to imagine that a teaching laboratory can turn out a young man intimate with the details of a modern manufacturing process. At best, the student gives three years to his preliminary training, and a couple of years to research. On the occasion of the similar discussion at Dublin two years ago, it was generally agreed that it takes ten years to make a chemist. But the manufacturer cannot fairly be blamed for expecting results too soon. It is an attitude in which he has been in some ways encouraged from the academic side.

There has been, and we fear there still is, in some quarters, an increasing tendency for the governing bodies of universities and technical schools to believe that in order to fit students for technical posts, it is necessary to provide some miniature manufacturing plant with the aid of which the student may be initiated into the routine of a manufacturing process. Now this is not the real object of University training. The business of the University or technical school is to turn out a man of an entirely different type; one who not only brings to the industrial world an ability to absorb, rapidly and fully, the details of what is to him a strange process, but, what is much more important, brings also a capacity to see a new problem as it arises, to grasp its inwardness, and to recognise the lines on which its solution may reasonably be attempted.

This capacity is of much greater value than any amount of either rule-of-thumb knowledge or other learning. How is it to be cultivated? Certainly not by attempting in the laboratory to teach process details which can be learnt thoroughly only on the large scale.

It cannot be too strongly insisted that neither is the end to be achieved by the instruction in science received by the *Pass* B.Sc. student, or, in many cases, by the ***Honours*** student. This instruction should certainly cultivate the powers of observation, but in the main it serves to supply the student with the knowledge to be utilised as tools in further work. He must proceed from learning the known to grappling with the unknown, from instruction in science to training in research. It is only when he has had sufficient experience in research work to have acquired the research point of view, that the student is fitted to pass from the University or school to the works.

To stop the training of the student short of this point and to turn him loose on the industrial world, ostensibly as a finished product of scientific training, is an injustice to the student, an invitation to failure, an almost certain discouragement of the manufacturer who employs him, and the casting of another stumbling-block in the path of progress.

The general attitude of the manufacturer seems to be that only those value higher education who have felt the need of it. In the main it is a need he does not feel, or, having felt the need, has, through ignorance of what he wanted or bad advice, appointed the wrong man, has perchance mistaken a laboratory assistant for a chemist, or has been supplied with a *pass* graduate masquerading as a trained scientist, with the inevitable result of disappointment and disgust.

A great deal may be expected from bringing the manufacturer into direct contact with the teaching institution by means of consultative committees, the advantages of which, it was remarked during the discussion, have already been experienced by Glasgow University.

The same end might be attained if the British Association would devote fewer of its Presidential addresses and less of the time of its sections to abstruse subjects suitable for discussion at the meetings of specialised scientific societies, and would concentrate its energies on demonstrating to the lay public in what manner, and to what extent, science is intimately concerned with the everyday affairs of industry and commerce.

**Copper.** The difficult subject of copper "futures" receives the attention of a writer in the *Financier* for September 21st. He remarks that, while consumption has increased, production has done the same, with the result that, up to August, very little impression had been made on the heavy stocks constituting visible supplies. During August the world's stocks were reduced by 2,455 tons, in the face of a record output in the States. This was, at first, supposed to indicate renewed activity in demand, but, in view of the depression in the steel trade, with which commodity copper almost invariably moves in sympathy, it does not seem at all probable that the consumption will continue near the same rate. The limiting of production, so long anticipated, is now said to be arranged for, and it is predicted that, by October, the effects of this policy will be apparent. It is stated that the Anaconda, Amalgamated, and Clark mines will curtail their production to the extent of 15 per cent. as compared with the corresponding period of 1909. At the same time, the writer in the *Financier* doubts the accuracy of the statement made by an American journal that "There is no large producer in this country or abroad that is not curtailing its output." What, he pertinently asks, is the Rio Tinto Co. doing? Its policy has always been to maintain its output at a steady and constant level, regardless of fluctuations in the price of the metal. It would seem, indeed, to be sufficiently obvious that, when America restricts its output to the extent of raising prices is precisely the time for European, Chilian, and Australian producers to increase theirs against the rise.

With reference to the amalgamation, it is pointed out that a combination which embraces only a limited number of producers cannot "force high prices." All it can hope to do is to prevent a further re-action in the value of copper by rigidly limiting the amount of metal which it puts on the market. We are, for that matter, assured on behalf of the combine that there is no intention to rush prices up, and that all that is wanted is an advance of one or two cents a lb., or about £4 a ton. Should the restriction of output at last come into operation there may be some buying on the advance thus brought about, but, in the face of the present heavy stocks, the influence will be some time in making itself felt.

**Turbine Contracts.** — Messrs. Jens Orten-Boving and Co. have booked the following further orders for large turbines :—

Trenton Power Co.—Four turbines of 1,500 H.P. with governors, working under a head of 20 ft.

Chicoutimi Pulp Co.—Two turbines of 4,500 H.P. each, working under a head of 75 ft.

Those last named are to replace wheels manufactured by an American turbine firm.

## THE MUNICIPAL TRAMWAYS CONFERENCE.

Following on Mr. C. J. Spencer's presidential address, to which reference was made in our last issue, came a paper on "The First Decade of Municipal Tramway Working," by Alderman Flint, of the Leicester Tramways Committee.

The paper, which we do not propose to reprint, deals in a general way with tramway development and finance during the past 10 years. The Alderman discusses from his own standpoint, as a Committeeman, many details of tramway operation which have presumably impressed themselves upon him in connection with the Leicester undertaking, and concludes with seven pages of statistical information, which, although correct, as the Alderman assured the meeting at a later stage, are nevertheless liable to be misleading, and, indeed, are really valueless, without a mass of additional information, for any accurate understanding of the relative results of the undertakings which he names.

The Alderman deals only with the 84 undertakings which are owned and worked by the same authority, and, of course, represent the pick of the tramways in this country, and one can scarcely disagree with him that these undertakings, in bulk, make a very satisfactory showing. He is impressed with the necessity of safeguarding the ratepayer, and in this connection the ever-growing demands of tramway employés evidently cause him some misgivings. He considers that an effort should be made to secure some degree of uniformity in regard to wages and employment conditions of tramway men, as every concession granted is used as a lever to obtain similar concessions elsewhere.

This paper drew a lengthy and not uninteresting discussion, which was opened by Councillor Rodgers, chairman of the Newcastle Tramways Committee. The difficulty of safeguarding the small margin which spells success has been experienced in Newcastle, and Councillor Rodgers naturally did not take such a rosy view of things as did the author of the paper. He did not think we could say that municipal tramways had fulfilled all that was promised of them. Why was it that such a large proportion of municipalities did not work their own tramways? Mr. Rodgers proceeded to dissect the financial results given, and concluded that if a few of the larger systems were omitted the profits would approach vanishing point.

Touching on municipal working, he feared the rabid municipaliser who was always pandering to the people. Public utility, especially at a loss, was less important than sound finance.

Mr. Rodgers complained that the large concerns forced the hands of the smaller ones in the matter of concessions to employés, drawing a striking contrast between the skilled mechanic on Tyneside, of from five to seven years' training, who obtained no better wages than an unskilled man who, after a few weeks' training, was appointed to drive a tramcar and obtained constant employment at that. This was putting the tramway men on a pinnacle. The big centre could afford to waste its profits in this way, but if the smaller towns had to follow suit it meant death to municipalisation. He advocated uniform resistance to demands of this kind; tramways should be conducted on business lines, and not as a form of cheap philanthropy.

Mr. H. Mozley (Burnley) said that figures in the mass did not give the true results of tramway working. Tramways should be regarded as an investment, and unless 6 or 7 per cent. was earned, the result was not really satisfactory. He questioned whether tramway employés were being paid on such an exorbitant scale, having in view the wages paid to the old steam tramcar drivers and the class of men now employed.

Councillor C. F. Spencer (Halifax) believed in the success of municipalisation in the aggregate; looked at through actuarial eyes they were a sound asset, and they resulted in many indirect benefits to the community.

Mr. H. E. Blain (West Ham), on the subject of the very numerous concessions asked for nowadays, urged the necessity of leaving philanthrophic matters to the public purse, in view of the trading character of a tramway.

Mr. J. M. McElroy (Manchester)—who is in the fortunate position of managing a very prosperous undertaking—looks at matters from the point of view of the general good of the community. American critics claimed that municipalisation of tramways tended to create artificial boundaries between town and country, and he considered that if we were to spread the people and obtain the benefits claimed for cheap transit, it was necessary to extend beyond local boundaries. In the same way he blessed the combined generating station, and tabooed high receipts per car-mile. Profit he defined as interest, sinking fund and rate-aid contributions, but not sums applied to depreciation. It is not every tramway manager who has the courage to look at things through Manchester spectacles.

Mr. J. Dalrymple (Glasgow) advocated the unification of fares and conditions of employment, the granting of certain facilities to sections of the public, &c.

Alderman Trumble (Croydon) told how electric lighting surpluses had stimulated his Committee to adopt meters on the cars, resulting in an anticipated saving of some £6,000 in energy cost this year.

Mr. J. R. Salter (Lancashire United Tramways), in responding to an invitation to speak, unfolded a tale of woe as to the obstructive tactics of certain South Lancashire authorities, which he condemned as unfit to be municipal traders. As a company man, he protested against the unlimited expenses imposed on tramway companies by local authorities, and asked how it was possible for companies under such circumstances, and bearing in mind that the fat tramway areas were all worked by municipalities, to show such good results as the latter.

While we cannot for a moment defend the illogical dog-in-the-manger policy of many local authorities, it is only right to remember that they may have been studying prospectuses and—well—have desired to secure a share of the huge estimated profits for the community. The combined generating station was no doubt better for a municipality, especially if the price of energy were arranged on a properly defined basis. The cost of road widenings throttled private tramway enterprise, as, he thought, it would have done municipal tramways had expenditure on the same scale been required.

The discussion lasted well into the afternoon, and when Alderman Flint had replied briefly to some of the points raised, but little time remained for the more technical paper of Mr. J. W. Dawson, assistant engineer, Bradford tramways, on "The Comparative Durability of Brake Shoes and Tires."

As we shall reprint this paper at some length, we merely record that as the result of laboratory tests under set conditions, he concludes that the durability and efficiency of a C.I. brake-shoe is a question of chemical composition, the combination of its constituents and methods of founding; that from the cost point of view it matters little whether shoe or tire wears most, and if financial economy is the only consideration, the shoe that gives the least combined wear per unit of cost will be the one to adopt. Messrs. McElroy, Fell, Yerbury, Mozley, Fearnley, and others, spoke on the subject, which has in one form or another received a good deal of casual attention in this country.

Mr. McElroy considered that the results were confirmed by Manchester experiments, and suggested the appropriateness of formulating standard specifications for brake blocks, tires and rails—a course which appeared rather premature to Mr. Fell. The author pointed out that the chemical composition of a brake shoe did not necessarily indicate its physical condition, and he believed that only a microscopic analysis would really be effective in controlling the output of the foundry.

Thursday's deliberations included a paper by Mr. A. Baker, of the Birmingham tramways, on "Tramways in relation to Town Planning," and a joint report by Messrs. Cross, Acland, Pringle, and Smith, on the "Lubrication of Car-Bearings." The former paper outlines a phase of tramway work which is somewhat unfamiliar in this country, where garden suburbs in plenty are springing up, thanks to private enterprise, but where the so-called "ideal" town suburb, municipally developed, with its pre-arranged tramway arteries, is yet to seek.

It will be seen that Mr. Baker's proposed main thoroughfares of from 91 ft. to 136 ft. in width, with their exclusive "ways" for the tramcars, depend largely on the possible cheapening of tramway construction due to the absence of

vehicular traffic on the "way," and, we imagine, to an even greater extent, on the complaisance of local landowners.

Mr. Baker apparently relies on securing the latter most desirable state of affairs by preparing his "town plan" before commencing negotiations. Whether this will secure cheap land we do not know, but the discussion revealed considerable scepticism on the point. This discussion also excited considerable interest among the "Council" representatives, speakers from Bradford, Birmingham, Bournemouth, Liverpool, Plymouth, &c., taking part, together with Messrs. P. Fisher and J. B. Hamilton.

Amongst the numerous trackless-trolley enthusiasts, it was evident that Mr. Baker is only a lukewarm adherent, and, of course, there is justification for his attitude as regards the schemes referred to in his paper, which anticipates a saving on the usual cost of tramway construction. In this connection it is interesting to note that Mr. Hamilton found in Leeds, that if he paid 7s. 6d. per yard for land for a tramway on private land, the cost of the line, owing to the cheaper construction possible, would be no more than that of building a tramway in the ordinary way on the public road.

The joint report on lubrication of car bearings, summarised replies to queries on the subject, which cover some 26 pages of printed foolscap.

In a general way it is evident that lubrication is being treated with greater respect than formerly, and it will not be surprising if a scientifically designed self-oiling car-bearing results from the investigations that are being carried on, which are admittedly incomplete as yet. The discussion was a very brief one, the first paper having absorbed more than its allotted time.

In the afternoon the members and friends, to the number of about 200, availed themselves of the invitation of the Halifax Tramways Committee to inspect the local tramway system. The party travelled to Queensbury on the Bradford cars, there transferring to those of the neighbouring city for a tour through the district. On the return journey a call was made at Bankfield, where the visitors were received by the Mayor of Halifax, and were served with refreshments; among those present was Mr. J. H. Whitley, M.P.

In the evening the annual dinner, held in the Victoria Hotel, Bradford, proved a very enjoyable affair; among the toasts submitted were those of "The City of Bradford," proposed by the Mayor of Halifax, and "The Municipal Tramways Association," proposed by Mr. James Hill, and responded to by the President (Mr. C. J. Spencer); the toasts were interspersed with musical selections rendered by local artistes.

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## Tramways in Relation to Town Planning.

Abstract of paper by Mr. A. Baker, General Manager, Birmingham Corporation Tramways, read September 22nd.

Everyone who has watched the rapid growth of our suburban districts of late years must have been distressed to have seen beautiful areas completely ruined by jerry-builders and others, who have cut up the land according to their own sweet will without any regard whatever to future development.

That greater powers than those existing before 1909 for dealing with this all-important matter were necessary, will not be denied, and for the sake of public and private economy, as well as in the interests of the public health, it is to be hoped that the Housing and Town Planning Act, 1909, will be energetically administered.

Part 2 of the Act deals with town planning, and Sec. 54 provides that a town planning scheme may be made in respect to any land which is in the course of development or appears to be likely to be used for building purposes.

The expression, "likely to be used for building purposes," includes any lands likely to be used as, or for the purpose of providing, open spaces, roads, streets, or for the purpose of executing any work upon or under the land incidental to a town planning scheme.

Under this section tramway men would naturally desire to see new roads, especially those likely to become main or arterial roads, of such width as would easily accommodate a double line of tramways, leaving ample room for other vehicular traffic.

Sec. 55 provides that the L.G.B. may prescribe a set of general provisions for carrying out the general objects of town planning schemes, and enables a local authority to prepare a scheme on lands adjoining its own, although such lands may be outside its own area.

Sec. 58 (1) provides that any person whose property is injuriously affected by the making of a town planning scheme shall be entitled to obtain compensation from the responsible authority—while (3) provides that where by the making of any town planning scheme any property is increased in value, the responsible authority shall be entitled to recover one half of that increase.

One, of course, recognises that the main object of the Act is to give local authorities power over the development of rural districts. It is impossible to plan afresh some of our old towns and cities. A start must be made in the outskirts, working inwards. In the course of years we may in this way get some really fine arterial roads, penetrating right into the centres of our cities.

Incidentally it appears to me that this question of town planning is one of the strongest arguments in favour of city extension.

Many populous cities are hampered by limited areas. The development of the outgrowths of these cities is being left to rural and urban district councils, who, in the nature of things, cannot have the same experience, or even the means, of dealing with such great problems as our city councils.

Means of communication is the first essential to successful town planning. Districts may be planned, suitable residences for business men and artisans may be erected, but, unless some cheap and efficient means of communication is provided, town planning must fail, and the Act of 1909 become inoperative.

Under the Act it is possible to restrict the number of houses to the acre. This means that the population must be spread over a greater area, and, consequently, further away from their work. It is imperative, therefore, that proper travelling facilities should be provided.

In most of our towns it is no uncommon thing to find areas with 50 or 60 houses to the acre. According to the Chairman of the Housing Committee of the Nottingham Town Council, no fewer than 510 houses to the acre exist in the "Narrow Marsh" district of that city.

It is obvious that it is cheaper to transport a number of persons congregated at a given point than to collect the same number of persons from several different points spread over a large area. It, therefore, seems that town planning will not cheapen operating costs, but rather tend to make them heavier, as more work would have to be done for the same money.

It is well known that on the majority of our tramways travelling cannot be cheapened.

Without attempting to discuss this matter in detail, it is certain that the margin of profit on each fare is exceedingly small. In Birmingham, where the average fare is only nine-tenths of a penny, we have to carry 10 passengers before we make a penny profit. It is, of course, only on the enormous number of passengers travelling that we are able to pay our way.

It is equally certain that the cost of tramway operation cannot generally be reduced.

In connection with town planning on the Continent, special provision in many of the new wide thoroughfares has been made for tramways.

In some cases avenues in the centre of the streets have been specially constructed for tramway lines—other vehicular traffic not being able to use this part of the thoroughfare. In other cases the carriageway is divided into two portions, each of considerable width, by an avenue of trees.

Where this has been done the tramway tracks have been laid close to the footpath on either side of the avenue, leaving ample room for other vehicular traffic. By these means a much higher average tramway speed can be attained. Again, where new thoroughfares have been made in sparsely-populated districts and traffics are light, a cheaper method of tramway construction has been adopted. This is particularly noticeable in Berlin. In this city macadam paving has been largely employed, and as the ordinary wheeled traffic does not pass over it, it appears to be quite satisfactory as a tramway paving. In other cases no paving of any kind except at crossings has been used, but the rails laid on sleepers and the space between the rails filled in with green turf. This not only cheapens the cost of construction and maintenance very considerably, but the effect of well-kept grass in the tramway areas is most pleasing.

There can be no doubt that in making a town plan it would be wise policy on the part of the authorities to make the main thoroughfares sufficiently wide while the land is cheap, so as to provide a "way" exclusively for trams, and thus to lessen the cost of construction.

The advantage to tramway traffic and to the ordinary vehicular traffic by having a portion of the road set apart exclusively for tramways is enormous. Besides obtaining a better average speed, collisions with other vehicles are obviated, and general repairs to permanent way, by its only being used for tramway purposes, considerably reduced.

The area required for a double line of standard gauge tramway is 17 ft. If the carriageways of all the new main thoroughfares were made 91 ft. in width minimum, there would be plenty of room for a special tram "way." A thoroughfare of these dimensions would provide for two footpaths each 10 ft. wide, two roads for vehicles each 24 ft. wide, and a way for trams 23 ft. wide.

The 23 ft. allowed for in the tram "way" would give two footpaths each 3 ft. wide for passengers leaving the cars, thus permitting them to alight in safety instead of having to step straight on to the carriage way.

Really magnificent thoroughfares can be made varying from 103 ft. 6 in. to 136 ft. at no great additional cost when the land is undeveloped.

If at the same time trees were planted on each side of the tramway, thus forming a tramway avenue, much of the objection to trams in suburban districts would be overcome, and a charming effect produced.

Paving forms a very considerable portion of tramway construction; the paving of one mile of double track costs approximately £3,000.

By adopting this method of construction, which is really only possible in new districts, and through the agency of town planning, a very large saving can be made in the capital expenditure on tramways. There is no doubt that in many cases the land-owners would be willing to give up the extra width required to make the wide thoroughfare here described, knowing that they would be benefited enormously by have such a main road adjoining their property. But even where this could not be arranged, the price of agricultural land even near a large town could not be more than £100 to £200 per acre. Presuming the tramway authority was called upon to add 6 yards to the width of the road, this would mean an addition of 6 yards × 1,760 yards for every route mile, or, say, 10,000 square yards. This, as I have said, would in many cases cost nothing, and in no case should cost more than £400 per mile. In such a case a reduction of capital expenditure of upwards of £3,500 per mile of double track could be immediately made, allowing for the extra strip of land, besides the very considerable saving that would be effected annually in repairs and maintenance. Such a cheap form of construction would enable tramway extensions to be made into districts of light traffic, which, under present conditions, cannot be contemplated.

In this connection a cheap form of tramway construction is far more likely to assist town planning than any other form of traction, not even excepting the railless trolley system as we know it.

Doubtless the trailless trolley system has a useful purpose to fill, but there is no doubt that in districts which are capable of showing any signs of development, it would be much better policy to lay down a tramway, and face a loss for a year or two, with the prospect of the tramway becoming remunerative at a later date.

Trackless trolley cars can never deal with large masses of people like tramways.

There is another lesson I think we may well learn from the Continent. In the new part of the old town of Ulm a great deal of land development is taking place, the Municipality having purchased large tracks of land which they have town planned.

The trams also belong to the Municipality, and communication has been provided between each district.

These tramways do not at present pay their way—indeed, there is a considerable annual loss on working. The Municipality, however, is not at all concerned about this, because, whatever the loss on the tramways amounts to is made up several times over by the profit on the sale of the land, and in the advantages accruing by having the town laid out on well-defined principles, to say nothing of the benefit accruing to the town by reason of the low death rate which inevitably follows the making of open spaces instead of congested areas. In Vienna, Frankfort-on-Main, and the great industrial city of Mannheim, the same policy obtains, although perhaps not to such a great extent as in Ulm, viz., that wherever new developments in land are taking place, communication by tramways must be established, even though there is not much prospect of profit immediately accruing from the tramways.

In these towns it seems to be the settled principle that means of communication must precede population.

In this country public companies certainly would not lay tramways without a prospect of immediate profit. Municipalities, on the other hand, have not, in the majority of cases, been allowed to embark on schemes unless the immediate financial aspects have been quite sound. This being so, the very important question is raised as to whether, in view of the new Town Planning Act, Parliament might not modify its view that tramways should not be constructed unless they can be shown to have an immediate prospect of yielding a profit.

There can be no doubt that, if tramway proposals are to continue to be turned down on financial grounds, the progress of town planning must be much retarded.

I think it is of the utmost importance that tramway committees and their officers should keep in close touch with those charged with the conduct of housing and town planning affairs, instead of working separately and apart, as is sometimes unfortunately the case in municipal matters. Happily this is recognised in Birmingham, where a town plan is in course of preparation, and several conferences between the Tramways and the Town Planning Committees have already been held. It is recognised that both subjects are so closely allied that they cannot profitably be considered apart. I may also say that the town plan referred to provides for arterial roads varying from 80 ft. to 120 ft. in width.

### Discussion.

Alderman Priestley, Chairman of the Bradford Tramways, in opening the discussion, said the proposals were admirable in theory, but their carrying out was another matter. The Bradford tramways were recognised as a factor in spreading the population, and a garden suburb was being opened up, which would not have been the case but for the tramways. He questioned the possibility of obtaining land in the Bradford area at the figure given by the author, and put in a good word for the trackless trolley system. The great stumbling block to developments of the kind proposed was in the Council Chamber, if land had to be acquired for wide roads.

Councillor Barrow (Birmingham) said they had had no difficulty in their area in dealing with landlords on the outskirts, and the roads proposed by Mr. Baker were already planned, and would exist in a year or two. The population on the outskirts of Birmingham was growing rapidly, four districts alone showing a growth of from 88,000 in 1891 to 230,000 in 1908, and it was evident that some definite scheme of extension was wanted. The growth of the travelling habit was a safeguard to the use of tramways in new districts.

Dr. McCalmont Hill (Bournemouth) suggested that the thoroughfares proposed were not ideal, as the tramway lines should be adjacent to the pavements for convenience, rather than in the centre of the road. His own town was on the verge of a town planning scheme, and he regarded the Town Planning Act as one of the wisest pieces of legislation.

Mr. Peter Fisher (Dundee) considered it better to establish a trackless trolley system, which could be run without loss in the first instance, rather than to put down a tramway immediately in a new district.

Alderman Smith (Liverpool) objected on well-known grounds to tramways at the side of the road. His city was not blessed with grand dukes as landlords, but it had earls and marquises, and they were not always easy to deal with in financial matters. He did not believe in running tramways at a loss, even for a few years, on the chance of making money in other ways later, and recalled an experience of his own city, which had waited some 25 years for a Corporation estate to develop. The author's talents were wasted as a land buyer, if he only gave £100 an acre for land; in Liverpool the cost was much more like £500 to £1,000 per acre.

Alderman Dunsford (Southampton) and Councillor Stevens (Plymouth) favoured trackless trolley developments, and the latter mentioned that a local pioneer tramway had been built through a 30-acre building site, the owners of which had guaranteed the tramways against loss; the site was built up in three years, and the tramway had actually not lost a penny through the transaction.

Mr. J. B. Hamilton (Leeds) said the author's proposals, though ideal, were very much a matter for the future. Mr. Baker's idea seemed to favour speculation in land outside the borough, and it was not certain how this would turn out for the ratepayers, or how they would view the matter when large tracts still remained undeveloped inside the municipal area. In places like Leeds, immense districts sprung up at the penny stages. In cities with wide spreading tramway systems, it was found that the central zone increased in value, but the next zone contained many empty houses, &c., and decreased in value, while further out a prosperous zone was reached. If they were going to raise the principle that a tramway might appreciate land, and ask for some return to the tramway authority, it seemed only fair that the people whose property was depreciated nearer in, should obtain some compensation. He agreed with the author, that if it was possible to make a tramway at less cost than usual, it might be better to do so, rather than employ the trackless trolley system, which, however, had its uses in older districts where wide roads were out of the question, but where travelling facilities were required. He had found in Leeds that he could afford to pay 7s. 6d. per yard for private land for a tramway, as, owing to the cheaper construction, it would cost no more in the end than building the line on the public road.

Mr. Dalrymple (Glasgow) said when they had widened roads for tramway purposes they found the local landowners willing to give the land free, in view of the improvement in the property which resulted.

Mr. Baker, in replying, said it was a fact that agricultural land within 5 miles of Birmingham Town Hall could be purchased at from £100 to £200 per acre. The town plan was, of course, prepared before anything was said about purchasing land. He considered that the trackless trolley overhead network was a complicated arrangement, which would required to be largely replaced if tramways were subsequently wanted. In the new wide roads, the cheaper form of tramways suggested were preferable. He knew that he differed from his colleagues in the matter of the trackless trolley system, although it had its special uses.

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**A New Cable Factory on the Thames.**—The directors of the Deutsche Kabelwerke Gesellschaft, of Berlin-Rummelsburg, have resolved to increase the company's share capital from £175,000 to £262,500 by the issue of new shares of £87,500, which have been taken over by the Dresden Bank at the price of 115½ per cent., including all the costs of the emission, and are to be offered to existing shareholders at 125 per cent. The new capital will serve the purposes of extinguishing the bank debt, the extension of the German works, and the erection of a branch factory in England. It is stated in this connection that the work is to be proceeded with by the English connection—the Union Cable Co., Ltd.—on the banks of the Thames, near London, and that this company will, consequently, also raise its share capital. As far as the German business is concerned, the management holds out the prospect of a higher dividend for 1910 than the rate of 7 per cent. paid for 1909, this being due to the satisfactory condition of the cable trade, excepting submarine cables.

**"Onewatt" Lamps.**—Messrs. Siemens Bros.' incandescent lamp and fittings department, Tyssen Street, Dalston, inform us that they are placing on the market a range of 50-volt "Onewatt" lamps, of 10 and 16-c.p., in bell-shaped and spherical bulbs. They are now listing battery lamps, 1·3 to 16 volts; 100-c.p. lamps, 200 to 250 volts; and 10 and 16-c.p. lamps, 20 to 50 volts, all of the "Onewatt" type with drawn tungsten filaments. The prices of the new 50-volt lamps, we are informed, are low, and Messrs. Siemens Bros. are prepared to supply quantities of literature regarding them upon receipt of application accompanied by trade card. During the coming lighting season other types of "Onewatt" lamps will probably be placed on the market.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### The Association of Mining Electrical Engineers.

With further reference to this subject, my previous letter really was in reply to the following extract from the Electrical Review of September 2nd, 1910 :—

"It is our opinion which we have reiterated over and over again that the only solution of this question is the granting of a certificate to the engineer who must be thoroughly acquainted with both the mechanical and electrical engineering of collieries and trained to the work in the same way as the certificated colliery manager is now trained, and who will have absolute control and responsibility. At present there would be difficulty in finding such men, but as their status and consequently their pay would be raised, there would soon be a class of men available and ready to present themselves for examination. We had most earnestly hoped that this would be the aim of the Association of Mining Electrical Engineers, but unfortunately this is too hopelessly in the hands of the colliery managers to be expected to do anything to advance this very desirable change in the management of our collieries and the consequent reduction of accidents."

Now even the E.R. admits that at present there would be a difficulty in finding such men.

This statement I agree with, and may even go further by saying that out of 4,000 collieries in the United Kingdom it would be very difficult to find even 100 men thoroughly trained in mining, mechanical and electrical engineering.

It may be interesting to "Non-Council Member" to know that we had great difficulty in having the question of examinations and granting of certificates included in our Articles of Association. It was suggested that we should drop this question, as there is a possibility of the Board of Trade issuing certificates themselves. Had we done so, what would our members have thought of us?

Further, it would seem that we are in the undesirable position of being controlled by two Government Departments —the Board of Trade and the Home Office. Our Colonies show us our faulty legislation. They have all matters relating to mining embodied in a Mining Ministry.

However, having carried our point on the question of examinations, the value of which will depend upon the severity of them, we shall be in a better position to tackle the question with the higher authorities when we have a sufficient number of qualified members to put forward as a representative body, and, personally, I consider it very unjust of such a representative journal as the E.R. to say that we have done nothing or that our original intentions are not being proceeded with.

"Rome was not built in a day" is an old saying, and if a review is taken of the strong opposition to any reforms in working conditions of colliery work during the last 50 years, it is only reasonable to ask for a little time for us to carry out or put forward such ideas for the efficient working of colliery plants as will tend to minimise the risks and number of accidents in mines.

As regards the question of the colliery manager member, we should be broad-minded on this point. In the majority of cases he is only a servant of the colliery owner, and has to work for the latter's interest to the best of his ability. Unfortunately, he has so far in most cases taken advantage of his position and certificate to depreciate the electrical man, and even in my own case I have been boycotted in several cases on account of my connection with the Association, but this is a matter which I fully consider will wipe itself out very soon, especially as the younger men with advanced ideas come to the front.

Although the prosecution in Scotland, namely, Home Office *versus* Leckie, *re* "Competent Man," was considered a fight between colliery managers *versus* Home Office, I have every reason to think that the defence was absolutely supported by the coal owners, and the failure of the case shows the inefficiency of the Home Office or its representatives. To my mind the case was a very clear one, and could only have ended one way.

It was undoubtedly a setback to the electrical question, and only shows the possible strong opposition likely to be met with in effecting reforms by those whom the reforms will affect.

Until we have shown that we are a representative body and worthy of recognition, it would be fatal to our interests to rouse the opposition of older bodies and stronger interests representing the mining industry. We are at present only a baby body, and must feel our way and be diplomatic.

We submitted our views in our evidence to the present Commission for Revision of Rules, and it remains to be seen if any notice will be taken of the same. As yet we are not in a position to assert ourselves strongly on immediate reforms, nor can we take steps to enforce same on the lines of a Trade Union.

It is a matter of time, and I consider it a very short-sighted policy on the part of those critics who accuse us wrongfully of doing nothing. We must first qualify for the position of being able to do something.

In view of my previous correspondence, I hope the Editors of this journal will not consider that I have changed my original opinions because it pays me to do so.

The opinions expressed herein are the outcome of discussions with various sections of the mining industry, from coal owner to coal producer, and if any member of the Association can put forward any tangible programme whereby we can obtain our objects immediately, I, for one, will be very pleased to receive it.

I consider I have fully digested all the matter on the question of status which has appeared in these columns from time to time; and in the interests of the Association and its members, in supporting any suggestions on this question, wish to make sure of ultimate success and not run any risk of failure.

Having thus expressed my personal views on the matter as far as is convenient, I conclude by informing the Editors that the number of colliery manager members does not represent 20 per cent. of the total membership of the Association, and I therefore, absolutely deny their statement that we are hopelessly in their hands. The objects for which the Association was formed will be carried out.

**A Council Member.**

### Overcrowding in the Ranks of Central Station Officials.

I am pleased to see that the question of an association or trade union for station assistants has again been revived by "Justice." It is painfully evident to all rational beings that therein lies the remedy. My personal experience, however, leads me to concur with "Justice" in saying that they have neither the pluck, loyalty, nor enterprise to form a union. Whilst correspondents are engaged in controversy as to which is the better: premium or non-premium pupil, station-trained man, or workshop trained, our attention is naturally diverted from the question of far more importance to engineers, and one which affects them in a greater degree. May I ask the exponents of "workshop" and "central station" training whether they, with their respective trainings, or a combination of both, have been singularly fortunate enough to have had their salary influenced thereby?—If so, then their training, beyond doubt (to themselves at least) is the best.

On the other hand, what about the rest of the unfortunate crowd, who receive but a pittance, yet who, rather than place themselves in position to demand a reasonable living wage, are pleased to call themselves "Electrical Engineers," at salaries ranging from 15s. to 30s. per week, while navvies can command 6d. per hour, and have no degree of respectability to maintain? Could anything be more deplorable than this, yea, even amusing! Station assistants! how much longer is this state of things to be tolerated? The reluctance on the part of station assistants to form a union is in no small degree due to their possession of "Pigeon Pride." The foregoing remarks are not intended to apply generally, but rather to the "Superior Fellahs" of the profession, also the "weeds"—those who, possessed not even of ordinary ability, yet thrive under the patronage of a "good chief," or an uncle on the corporation. An organisation of station assistants would be a step towards effectively

checking this and other wrongs which become more apparent daily. To unfortunates and others—if you wish to have redress, cease to be passive resisters, and instead of engaging in discussion of your wrongs in technical journals, be active resisters, and engage upon a constructional policy which will end your troubles once and for all, and questions of premium pupils, works training, central station training, bad chiefs, bad jobs, and bad salaries, and "bad 'uns" generally, may then be thrashed out in a proper manner—in short, form a Trade Union. Station assistants, do it now!

**Degede.**

P.S.—I should be pleased to have the opinions of other readers, and to hear from anyone desirous of proceeding with the matter; letters could be sent to the Review.—Degede.

### Lightning Conductors.

The very interesting correspondence which has been carried on in your columns under the above heading for the past few months has apparently run its course, and it only remains for me to offer a word of thanks to the various gentlemen—including yourself, Sir—who contributed to it.

It is fairly evident that unanimity on the best method, or methods, of erecting lightning conductors has not yet been secured, and I think I am correct in saying that some considerable time has elapsed since the question was discussed so fully and instructively in your columns.

A point I had in mind when I first wrote, was to find out if possible whether the new rules brought out under the Phœnix Fire Office were, in their opinion, of such importance that they were prepared to offer a reduction in premium in those cases where conductors were erected in accordance with these rules. This information might, doubtless, have been obtained on application to the Office, but although I am not at the moment able to speak with certainty on this point, I understand that no abatement is offered. It is probable, therefore, that the great majority of conductors will continue to be erected in the manner which is to be seen on the Water Tower at Shooter's Hill.

In connection with this tower, I called a few days ago to see the exact method of fastening the conductor to the building, but I found I had been forestalled, for some hardened villains had fastened a channeled sheet-metal cover over the conductor for many feet above my head. I suppose it was considered that no more inspection of this conductor by "casuals" need be made.

However, during the coming winter I perhaps may have the pleasure of meeting Messrs. Alfred Hands and Killingworth Hedges at the Institution on the Embankment (although I gather that the former is not yet a member) and if comfortable quarters for an informal discussion cannot be obtained there, we can adjourn to a cosy place that I wot of, and there with the aid of tobacco and strong cordials, the matter may be further thrashed out, and I may be able to form some definite opinion as to whether I should alter the rather numerous conductors under my care to the recommendations of the Phœnix Fire Office and the Lightning Research Committee, or let them remain as they are.

I have an idea, however, that I should decide to leave them alone.

**W. H. B.**

### Coal-Cutting Machinery and Electrical Accidents in Mines.

The writer of the article in kindly replying in last week's Review to my queries, *re* efficient "earthing" of colliery installations, does not, I note, give any reasons for his assertion that a bare earth wire is preferable to an insulated one.

In the absence of his reasons, and believing, too, that the chances of an earth wire becoming disconnected or broken on bank (or in the shaft for that matter) are somewhat more than remote, I cannot help but think that the presence of the bare wire in the mine is a possible source of danger.

In view of the prejudice against the use of electricity in mines and of the fact that safety is the chief point to be considered in the erection of electrical plant, is it not essential that all possible sources of danger be eliminated?

**Austin Burdon.**

### Calculation of Illumination.

"M. F. H. W.'s" new contention is as erroneous as his last, and it is obvious that he is again handling tools the use of which he does not understand.

In my article on the "Calculation of Illumination" I gave curves showing the candle-feet of illumination at various radial distances out from the foot of the perpendicular through the source of illumination, allowing throughout for the varying angle of incidence of the rays. The mean ordinate of this curve has a definite and obvious physical and practical meaning, which meaning is, I think, set forth sufficiently clearly in the original article.

I have nothing further to add to the remarks I have already made. The conditions I have assumed are, I believe, sufficiently comprehensible to anyone conversant with the subject. The accuracy of my integrals I have checked by experiments.

"M. F. H. W.'s" expression for mean illumination is, by itself, correct; but it has nothing to do with, and certainly does not contradict, the methods I employed and the results I obtained.

**C. Toone.**

Kent, *September 21st*, 1910.

### Electricity in a Laundry.

I am contemplating the introduction of some machinery into my hand laundry, commencing with a washing machine, hydro and calender, and am in doubt as to what will prove the most economical driving power.

In a great many respects I would prefer electric motors, but as I am bound to have a boiler to heat water and the bed of the calender, it appears to me that it must be cheaper to have all the machinery steam driven.

Perhaps some of your readers who are familiar with the working of laundry machinery will be kind enough to enlighten me on this point.

**Hand Launderer.**

### Electricians' Employment Bureau.

Owing to the above-named body having been described at various times in your "Correspondence" columns as an Electricians' Union, it has, unfortunately, been confounded by some people with the "Electrical Trades Union," and I am desired to write and point out to your readers that this so-called Employment Bureau has no connection whatever with the Electrical Trades Union, and that although the Electrical Trades Union endeavours, wherever possible, to secure employment for its members, there are no fees charged for this purpose. As we have been subjected to some hostile criticism through this similarity of names, I trust you will publish this disclaimer.

There is one other matter I am also desired to inquire about. Some weeks ago an advertisement appeared in your paper for 10 wiremen and 10 mates, and stamp for reply was asked for. Several of our members replied to this advertisement and enclosed stamp, but up to date have received no reply. Can you say if this was a genuine advertisement, or a cheap method of procuring postage stamps?

**J. Rowan,**
*General Secretary, Electrical Trades Union.*

Manchester, *September 23rd*, 1910.

[With regard to the last two lines, the advertisement was received in the ordinary way of business, and beyond that we know nothing.—Eds. E.R.]

**Electric Production of Steel in Russia.**—The subject of the electrical manufacture of steel is engaging the attention of Russian iron and steel producers at the present time. In May of the current year the first electric furnace, which is of the Heroult type, and has a capacity of 3½ tons, was set in operation at the Obuchoff steel works near St. Petersburg. Now two other Russian works—the Iron, Steel and Mechanical Works Co., of Ssormovo, near Nishni Novgorod, and the Société des Hauts Fourneaux, Forges et Aciéries en Russia, of Makievka, in the Donetz region—have acquired licences for the working of the Héroult-Lindenberg process from the Electro Steel Co., of Remscheid. A 3-ton furnace is to be erected at each works for the production of steel for special castings and high grade steel.

# LEGAL.

### British Thomson-Houston Co., Ltd., *v.* Mackenzie.

At the Birmingham County Court last week, before his Honour Judge Amphlett, K.C., an application was made by plaintiffs through Mr. Cave, for the review of a memorandum of agreement filed in November of last year, for the payment of £1 a week to George Mackenzie, Handsworth, an electrician. Mr. Hurst appeared on behalf of the respondent.

According to the report in the *Birmingham Gazette and Express*, Mr. Cave said that the respondent, whilst employed by the applicants, on December 24th, 1906, met with an accident through the bursting of a naphtha can, and sustained burns on various parts of his body. He was unable to work for some time, and was allowed £1 a week down to May 2nd, 1908. In the following July he re-entered the employ of the applicants, and did precisely the same work at the same rate of wages until December, when the job on which he was engaged came to an end. There was, however, a question whether applicant had entered into an agreement under which he accepted £12 in satisfaction of all claims, and apparently, said Mr. Cave, the respondent's contention was that though he signed the agreement he did not read it; therefore he was not bound by it. His Honour Judge Ruegg, before whom the case had been previously argued, came to the conclusion that respondent did not think he was settling his claim when he signed the agreement, but because of his carelessness he deprived him of his costs. Counsel submitted that Mackenzie was guilty of negligence in not reading the agreement, and could not now go back upon it.

Dr. Gamgee stated that the injuries sustained by Mackenzie would not prevent him doing the work of an electrical engineer. The effect of a slightly contracted leg would mean a loss of agility, but not necessarily of ability.

The case is proceeding.

### A Liverpool Corporation Claim.

Before his Honour Judge Thomas, at the Liverpool County Court on Thursday, September 22nd, an action was brought by the Liverpool Corporation Tramways Committee against Messrs. Wallace and Agnew, amusement caterers, of Bootle, to recover damages arising out of a collision between defendants' traction engine and an electric tramcar.

The evidence showed that on July 12th the traction engine in question was drawing wagons from a show ground at Warrington, when it ran into the tramcar through the negligence, it was alleged, of defendants' driver. The Corporation claimed £17 1s. 9d. for damage to the car, and a further £81 for loss of the car's use while it was being repaired. The jury having decided in favour of the Corporation on the first claim, defendants then admitted their liability on the question of consequential damages, agreeing to pay £12 in settlement of it.

Judgment was entered for plaintiffs for £29 1s. 9d.

### Road Repair Arbitration.

Arbitration proceedings are taking place at Exeter, before Mr. P. Maybusy, County Surveyor of Kent, under an order of Mr. Justice Ridley, made at the recent Devon Assizes, at the Castle of Exeter, in a case in which the plaintiffs were the St. Thomas Rural District Council, and the defendants Messrs. Siemens, of Bristol. The claim was for £1,621 4s. on account of extraordinary traffic over the Council's roads. [The circumstances were reported in our issue of June 17th, 1910.]

Mr. J. R. Randolph appeared for the Council, and Mr. Ricketts for Messrs. Siemens.

Mr. Randolph, in his opening statement, pointed out that at the Assizes only the question of liability was tried, and judgment was entered for the Council with costs, the question of amount being referred to the arbitrator. The Judge gave defendants liberty to apply as to costs, so that all the arbitrator had to do was to say what amount the defendants were to pay. The only matter that he (Mr. Randolph) had to show the arbitrator was what was the amount of the extraordinary expenses which the Council incurred by reason of the damage caused by certain traffic. In the autumn of 1907 the General Post Office were about to lay a cable from Exeter to Taunton. They got Messrs. Siemens, the defendants, to make a cable to supply it, and to deliver it at certain points. This the firm did, and the cable was carried over the roads of the Council.

*(To be continued.)*

**Manchester Engineering Exhibition.**—The Engineering Exhibition promoted by the *Engineering Review*, which is to be held in City Exhibition Hall, Manchester, will be opened on October 14th by Sir George Reid. Luncheon at the Midland Hotel, with Sir W. H. Bailey in the chair, will precede the ceremony.

# NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### General Electric New Heating and Lighting Apparatus.

Many of our trade readers are already familiar with the appearance of the new showrooms of the General Electric Co., Ltd., in Queen Victoria Street, E.C., which formed part of a scheme of office re-arrangement and building alterations which

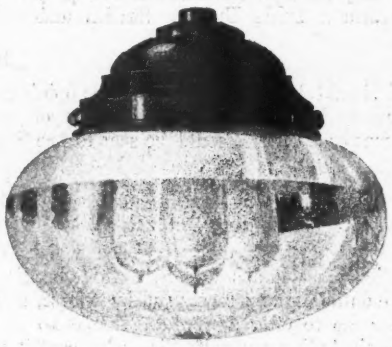

Fig. 1.—The G.E.C. "Village" Fitting.

was undertaken a short time ago to enable the firm to cope with its large and diversified electrical business. For the constant stream of trade buyers, and contractors, also engineers and architects with their clients, frequenting these well-known premises, extensive showroom accommodation, calling for systematic arrangement of a very wide range of electric light, heating and power manufactures, is, of course, a first essential, and this is now better provided for than it ever was. Not only has the company laid itself out thus for internal convenience, but, with the object in view of catching the eye of the passer-by, and so bringing the public into more immediate touch with modern electrical apparatus than is sometimes the case, it has arranged a series of window show-cases, within which there are placed all the latest G.E.C. productions that are required by the user of electricity in the home and business; a fairly frequent changing of the window contents will serve to maintain an interest when once it is aroused. Anything like a full study of the contents of these showrooms could not be made in the course of an hour or two, but when one is in the hands of those who know from constant touch the manifold developments that are taking place in the production of new manufactures, one's work is simplified. A few of the newer

Fig. 2.—The G.E.C. "Giant" Fitting.

lines to which our attention was drawn in the course of a brief visit last week may be alluded to here.

New literature is in preparation—of which we saw the advance proofs—showing a number of new fittings for shop-lighting service; among these is a simplified form of their well-known "Avenue" series in this class, for which there was a very large sale indeed. The "Village" lantern (fig. 1) is a cheaper kind of fitting than the ordinary "Avenue" type, with a similar globe. The company is also putting on the market for shop and street lighting a range of "Arcade" lanterns (fig. 6) in vitreous enamelled iron, taking Osram lamps from 50 to 400 c.p. So complete is the new range of these lanterns that they are made in all sizes up to their "Giant" fitting (fig. 2) which will take four 200-c.p. or three 400-c.p. Osram lamps. In fig. 5 we show the "Bridge" fitting for shop and railway station lighting; it has a blue and white enamelled iron shade constructed of a special shape to bring high candle-power lights in correct position for securing the best reflection effect.

For inside shop window lighting, also show-case and picture illumination, the new literature will describe a very complete range of new designs of reflector fittings all fitted with Osram lamps.

From among the new features of interest in the direction of cooking and heating apparatus, the "Marylebone" cooking range claims first attention. From the view of this stove shown in fig. 3. it will be observed that it is a really substantial piece of work.

Fig. 3.—The "Marylebone" Electric Stove.

The General Electric Co. is indebted to the Marylebone Electricity Department (more especially to Mr. H. H. Holmes, the commercial department chief) for valuable advice in the design and construction of this piece of apparatus, and it is this fact from which it derives its name—"The Marylebone." A considerable number have been supplied to the Marylebone department for consumers in that area, the design embodying various points that practical experience in touch with the cooking consumer have shown to be desirable. The stove can be seen in the G.E.C. showrooms, but it is also on view elsewhere, including the Hackney Borough Council's electricity showroom which was opened on Thursday last week. Our readers will be interested in the following details of this new line.

The outer case is of cast-iron construction throughout, all bolted together with edges and ornamentation ground, and polished. The inside of the oven is vitreous enamelled, and the oven is lagged all round, including the door, top and bottom, with 1½-in. non-heat-conducting material. The inside of the door fits into the oven 1½ in., preventing loss of heat. The oven is fitted up with two grid shelves, drip-pan, and damper-plate. The cooking space is 20 in high × 14 in. wide × 14 in. deep. The oven is heated by wire coils mounted on the sides of the oven, and running at a temperature about red-heat. The coils are run in grooved fireclay, backed by 1½-in. packing, so arranged that they can be withdrawn and inserted from the outside of the oven by undoing three screws and simply disconnecting the leads. There are two heaters, one at each side of the oven, which divide into one-third and two-thirds heat, controlled by two switches at the side, one switch giving one-third heat on each side of the oven, and the other giving two-thirds heat on each side of the oven. The terminals are of the pillar type, and contained in a cast-iron cover, vitreous enamelled inside. Efficient earthing screws are provided. The hot-plate top is arranged so as to give 7 in. of space on the top of the oven, which can be used as a hot cupboard or for a plate-warmer.

The grill is similar to the G.E.C. Standard H. 3,736, and is wired on the same principle. At the back there are two boiling rings, one controlled by a switch giving a low, medium and full heat, and the other controlled by a single switch. We are informed that the current consumption of this outfit is :—Oven, low heat, 800 watts ; medium heat, 1,600 watts ; full heat, 2,400 watts. One hotplate, single circuit of 1,000 watts. One hotplate, three heats of 500, 750 and 1,200 watts respectively. Grill, 1,000 to 1,100 watts.

Another novelty which will, we believe, receive considerable attention is the "Convertible" electric cooking and ironing outfit, which is seen in fig. 4. For the idea embodied in this device Mr. A. Money, of the Chiswick Electricity Supply Corporation, Ltd., is responsible, he having been impressed with the convenience of such a combination for the ordinary user of electricity who does not care to face the expense of a separate supply for cooking and heating purposes, with its accompanying outlay on self-contained electrically heated articles, such as kettles, hot plates, saucepans, &c. Whilst it is not claimed that the "Convertible" set is so efficient as separately heated utensils, it is certainly a useful equipment for the household. It requires no special fitting, and can be operated from the lampholder of any pendant, bracket or standard. After using for household ironing, the appliance is turned upside down on the special stand supplied, and is at once converted into a stove on which any of the utensils shown can be heated. The kettle is made of copper, and holds two pints. The saucepan is a double one, made of tinned-iron having a china interior, and holds one pint. The frying-pan is also made of tinned-iron.

Another useful device is the "Archer" electric toaster, which takes supply from any lampholder, and by which, after switching-on current for about three minutes to allow the toaster to reach the required temperature, toast can be made in about one minute ; two pieces of bread can be toasted at one operation. A leaflet giving further particulars of this inexpensive convenience is issued.

Fig. 4.—The "Convertible" Electric Cooking and Ironing Outfit.

Fig. 5.—The "Bridge" Shop Lighting Fitting

Fig. 6.—One of a Series of G.E.C. "Arcade" Fittings

## Westinghouse Electrical Supplies.

In our last issue we referred to the new "Electrical Supplies" catalogue that had been issued by the British Westinghouse Electric & Manufacturing Co., Ltd., of Trafford Park, for service during the current season. We have selected several of the more interesting lines from among the multitude of manufactures there shown and these appear in the accompanying illustrations. In fig. 7 is shown the "Trafford" safety switch lampholder, which was specially designed to meet the Home Office regulations, ensuring impossibility of shock as all metal parts are enclosed. It consists of a case made of special insulating material enclosing the porcelain interior of an ordinary switch lampholder. A special shade ring is provided which not only locks the shade in position but entirely

covers the metal bayonet cap of the lamp. The holder can be used with existing shades with 1⅛ in. hole, so does not require special shades. The "Trafford" patent push and pull switch-fuse appears in fig. 11. It is specially adapted for controlling public street arc lamps. It is claimed to be weatherproof, to give a quick make and break, the fuse-wire can be instantly replaced. It is specially designed to be of substantial construction at a moderate price, and is made for 500 volts. It consists of a porcelain replacement tubular fuse fitted with "knife" contacts, which is externally operated by a push and pull motion to close or open the switch. It is supplied either single or double pole, and in cases finished with stoved asbestos paint.

Figs. 8 and 9 show a couple of fittings for workshop and shop lighting. Fig. 8 will take four metallic-filament lamps, and has a 24-in. diameter reflector of enamelled iron. Fig. 9 represents a lantern designed for shop lighting and service in other similar situations, which is fitted with four Westinghouse "Auriga" metal-filament lamps. This lantern is finished in oxidised block enamel and fitted with an English glass globe; the two-light fitting of the same type is in solid copper. The other sizes supplied are for one and three lamps.

The Trafford safety-type hamp land, appearing in fig. 10, has also been designed specially to meet Home Office regulations. That shown is fitted with a switch-holder, but the lamp is also made with an ordinary lampholder, and of a watertight type. It is intended to avoid the danger entailed by using hand lamps with exposed metal parts attached, or in close proximity to the lampholder. The lamp-holder and lamp-cap are entirely enclosed in a substantial and highly-polished hard wood handle. The flexible leads are brought in through a special screwed fibre nipple and soft rubber bush, which grips the flexible and effects a watertight connection. The device is made in two types for indoor or outdoor use, the latter being made watertight by providing a well glass and rubber packing glands. The lamp cages can be sealed to the handle, so as to prevent any tampering with the lamp by unauthorised persons.

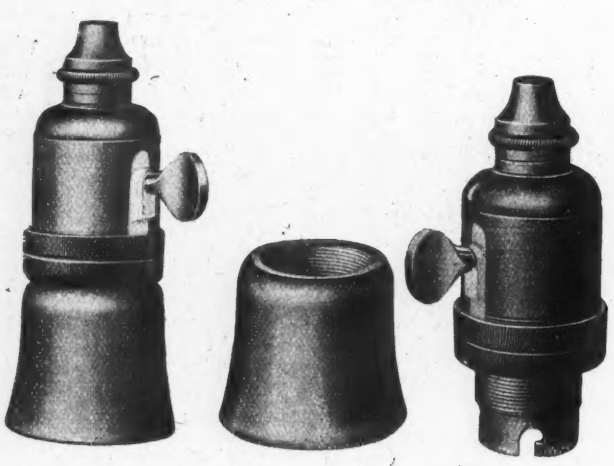

Fig. 7.

Fig. 10.

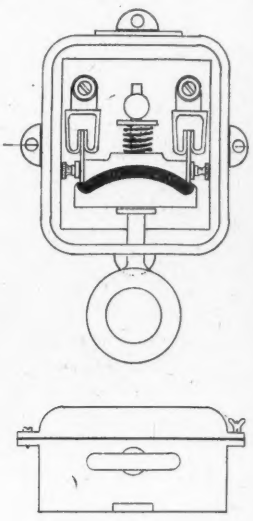

Fig. 11.

Westinghouse Electrical Supplies.

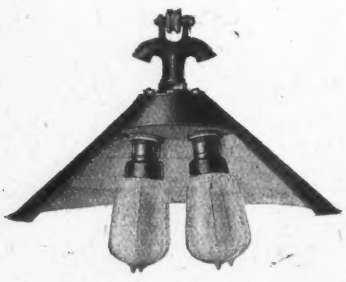

Fig. 8.

Fig. 9.

Westinghouse Workshop and Shop Lighting Fittings.

## "E.E. Coy" Vacuum Cleaner.

The Eclipse Electric Co., 77, St. John's Road, Bootle, have introduced a vacuum cleaner fitted with a double bellows, driven by a "Coy" motor of ¼ H.P. The cleaner is provided with rubber-tired wheels, and the metal parts are nickel-plated, so that its appearance is such that it need not be put away out of sight when not in use. An ample length of flexible, with lampholder or plug adapter, and a variety of nozzles, are supplied with the outfit, and the suction is such that we are assured that even a mouse has been caught by one of these machines. A porous bag retains the dust, &c., and is easily removed for cleaning. Hand-operated cleaners are also made.

## Kenny Chair Signal.

The development of the "electric theatre," with its continuous performance, has introduced new conditions demanding novel methods of treatment. Patrons arrive at all times, generally when the lights are down, and leave at equally variable periods, so that seats are constantly being vacated and refilled. In the impenetrable gloom pervading the auditorium (if that term can be applied where the performance is purely spectacular) it is difficult for the attendants and impossible for those who have just entered from the daylight to spot vacant seats, and the result is that much disturbance and inconvenience is caused to those who are watching the screen. To overcome this difficulty, Mr. P. T. Kenny has invented and patented an ingenious system of chair signals, which is being exploited by The Kenny Chair Signal Co., of 4, Rathbone Place, W. This consists in the attachment of a small post to the end of each row of chairs, in which are mounted as many miniature lamps as there are seats in the row. Each chair is provided with an electric contact which closes the circuit of one of the lamps when the chair is unoccupied, and thus shows at a glance along the gangway, exactly where the vacant seats are situated. Further, coloured glasses are attached to the posts as shown in fig. 13, which by their respective tints indicate the prices of the vacant seats, and alphabetical indicators can be added which remain alight while any chair in the row is vacant. Where this device is used it thus becomes possible to ascertain, even in pitch darkness, exactly which seats are occupied and which vacant, and to direct patrons to their places at once, without the slightest confusion in the gangway. The number of attendants may also be reduced. An extension of the system to the box office, if desired (fig. 12), enables the attendant there to display on an indicator fitted with similar lamps, the condition of the seating accommodation at any moment, so that parties wishing to occupy adjoining chairs can be shown instantly where groups of vacant seats are available. The system is obviously applicable to other places of entertainment as well as picture theatres, and certainly appears to fill a much-felt want.

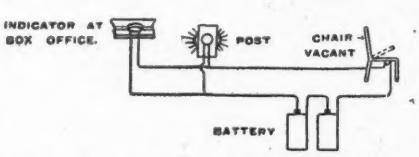


Fig. 12.—Connections of Kenny Chair Signals.

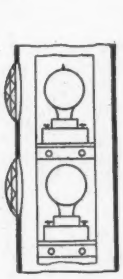

Fig. 13.

Fig. 14.—Chair fitted with Signals.

## "Sun" Screwed Tube System.

For the benefit of those who adhere to the screwed steel-tube system of conduit wiring, the Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C., have modified their "Kalkos" patent adjustable box to suit it, making the box of malleable iron with screwed nipples for the purpose. The leading feature of the box is the adjustment ring, by means of which the switch-plate can be brought flush with the finished surface of the wall, a range of ⅛ in. of adjustment being provided; and the switch-plate is also capable of adjusting itself to the surface, being secured by a milled ring, as illustrated in fig. 15. The adjustment ring is shown separately in fig. 16.

The boxes are all made with compartments affording a clear

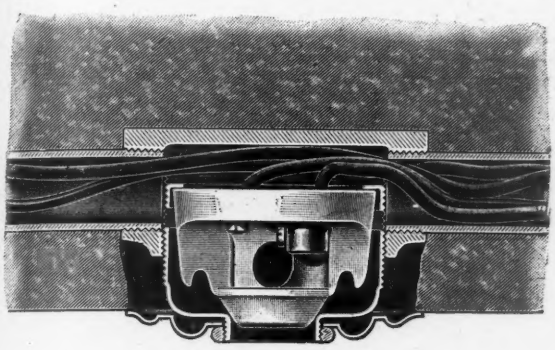

Fig. 15.—"Kalkos" Screwed Iron Box.

space between the base of the switch, plug, &c., and the bottom of the box, which can be used for joints, reducing the number of joint-boxes required, and the wires are always accessible. There is also room for running wires through the box, as shown. The boxes are made one, two or three-way, and largely obviate the necessity of draw-boxes, while they are made for surface, semi-flush or flush work.

A special switch has been introduced for use with the "Kalkos" tinned-brass tube and the "Sun" screwed-tube systems; this is only 1¼ in. deep, and is watertight. The live parts are sunk in the porcelain (fig. 18), so that live metal cannot possibly come into contact with the cover, nor can an arc be set up to earth. The dolly is effectively earthed in the act of screwing the cover into position,

Fig. 16.—Adjustment Ring.

Fig. 17.—Packing of Dolly.

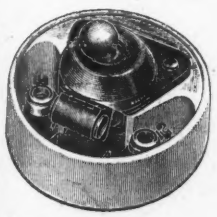

Fig. 18.—"Kalkos" Switch.

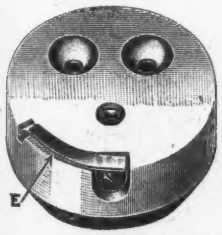


Fig. 19.—Automatic Earth Connection.

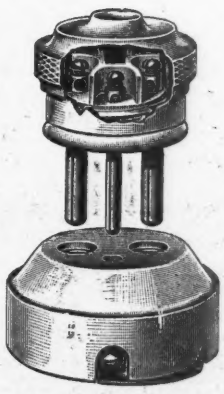

Fig. 20.—"Kalkos" Three-pin Plug.

and a packing P (fig. 17) is tightly pressed against the dolly D by the collar C, the cover being coned to fit the collar, so that the whole switch is watertight.

Fig. 20 shows the "Kalkos" three-pin plug, conforming with the requirements of the Home Office; this cannot be wrongly inserted into the socket, and a cord-grip takes all strain off the terminals. The earth connection is made automatically by inserting the socket into the box, with the spring contact seen underneath the socket, and at E, fig. 19; thus the wireman cannot omit to make this connection. A variety of other accessories has been devised in connection with the screwed-tube system, which appears to have been carefully thought out and brought to a thoroughly practical stage of development.

## Dowsing New Electric Radiators.

The luminous radiators of the Dowsing Radiant Heat Co., Ltd., of 24, Budge Row, London, E.C., are so well known that little need be said of them to-day. A good deal of publicity literature of a useful kind has, however, been issued by the company for the 1910-1911 season, this including a 48-page complete catalogue, wherein a host of different designs are shown, plain and ornate, for different classes of consumers. There are two new features which are sufficiently interesting to justify their receiving attention here, and we illustrate one of them below. Fig. 21

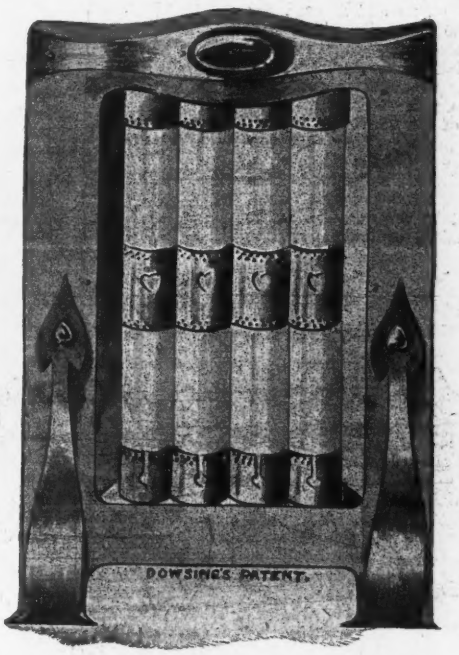


Fig. 21.—Dowsing Eight-Light Tubular Radiator.

is a novelty, inasmuch as it is an eight-light tubular radiator in which the lamps are arranged in columns. It is a registered design, and has an antique hammered brass frame with inlaid enamels. The height is 35 in., width 23½ in., and the depth 11¼ in. The makers have introduced it to meet a demand for a larger radiator than have been generally called for, which has followed the reduction in the heating-current charges of some electricity supply companies. The other novelty to which we refer is an ordinary four-lamp luminous radiator, but with a polished brass frame specially designed for airing linen, drying towels, &c.

## Portable Testing Transformer.

The Foster Arc Lamp & Engineering Co., Ltd., of Morden Road, Wimbledon, S.W., who have been very successful with their small auto-transformers, have taken up the manufacture of larger transformers, both of the auto and the double-wound types. One

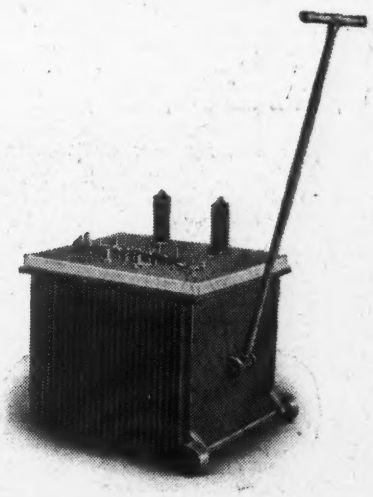

Fig. 22.—Foster Portable Testing Transformer.

of the latter is illustrated in the accompanying figure, which shows a portable testing transformer of 50 kw. output, giving pressures ranging from 200 to 30,000 volts. This is a handy adjunct to central station and similar equipments, where it is necessary to apply high-pressure tests to cables, &c.

E

## "Mazda" Lamp Fittings.

As our readers by now well know, "Mazda" is the title adopted by the BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, for their tungsten lamps. Of late one has been meeting the word in public places with a frequency which is bound to stamp it upon the mind of everybody. Of the lamps themselves we need say little, except to mention that in the new price-list (No. 254) a number of new lamps are included—12 in all—as follows:—12 and 16 C.P. for 24 volts; 45 C.P. for 50 to 55 volts; 16, 25, 45 and 100 C.P. for 60 to 80 volts; 14, 28 and 200 C.P. for 100 to 135 volts; 45—200 C.P. for 200 to 250 volts. This list gives general information regarding the lamps, marking for series running, prices, and so on. The B.T.-H. Co. have introduced a number of tungsten lamp fittings for the purpose of running the lamps in groups, for shop, ship, hall, or club-room lighting. The lampholders are supported on a sheet-metal platform, which can be readily raised or lowered so as to suit the type of lamp employed. The fittings are made of copper or zinc, and the standard finish is oxidised copper. The reflector is supported on a centre rod, and is nickel-plated. The globe carrier is designed to admit a continual flow of air, keeping down the temperature of the fitting. The globes are of flint glass, either clear or frosted on the inner surface, and are supplied either plain or with pockets. In list No. 229 a number of the different variations of these fittings are illustrated and prices are set out. The two blocks that we have selected as typical examples for illustration show a fixed suspension fitting with ceiling plate and pocketed shade (fig. 23), and a hook suspension with chain and plain shade (fig. 24).

FIG. 23.—FIXED SUSPENSION WITH CEILING PLATE; POCKETED SHADE.

FIG. 24.—HOOK SUSPENSION WITH CHAIN; PLAIN SHADE.

## Ironclad Fool-proof Switchgear.

MESSRS. BERRY, SKINNER & CO., of 78, Upper Thames Street, E.C., have devised a simple method of building-up switchboards suitable for use in collieries, engine rooms and other places where the switchgear is likely to be operated by unskilled or rough-handed workmen. It can be constructed entirely of metal, with mica insulation to all insulated parts, including the internal mechanism of the switches, and is therefore practically indestructible. It consists, as shown in the accompanying illustrations, of an angle-iron frame, to which the firm's standard switches, &c., are bolted; each ironclad switch and fuse unit is sunk into the framework, so as to project as little as possible, and it will be obvious that the switchboard can readily be extended without limit, or altered to suit any requirements. It is claimed that each unit is entirely fire-proof, and no live parts are accessible to the unskilled user; yet a blown fuse can be replaced on the spot without risk and without the possibility of disorganising any of the remaining units on the board.

For use in collieries and exposed positions the apparatus can be made perfectly watertight, so that a fire-hose can be played on it without fear of damage, and it complies with the Home Office regulations in all respects. It appears likely to be of great utility.

MESSRS. BERRY, SKINNER & CO., have also brought out a new oil-break fused switch under the title of the "Rockfeller," which is particularly suitable for use in mines. A section and plan are shown in fig. 27. The fuses, which cannot

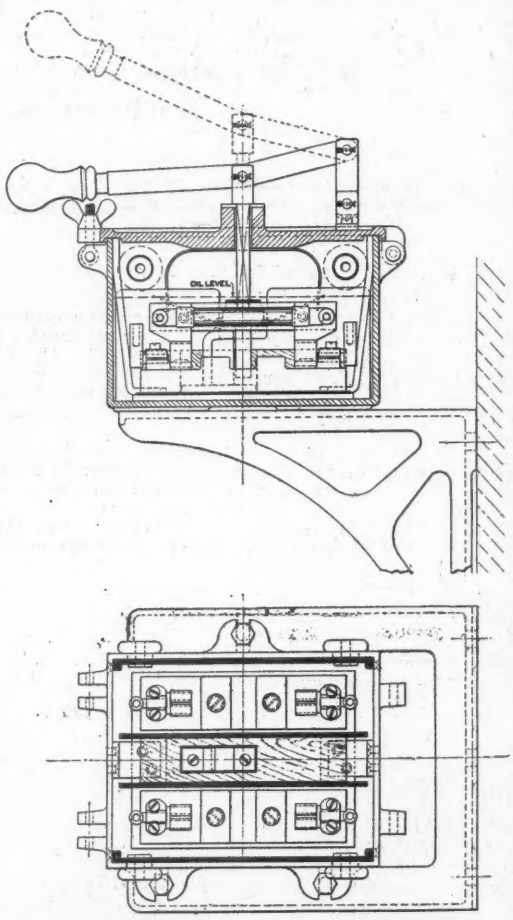


FIG. 27.—ROCKFELLER OIL-BREAK FUSED SWITCH.

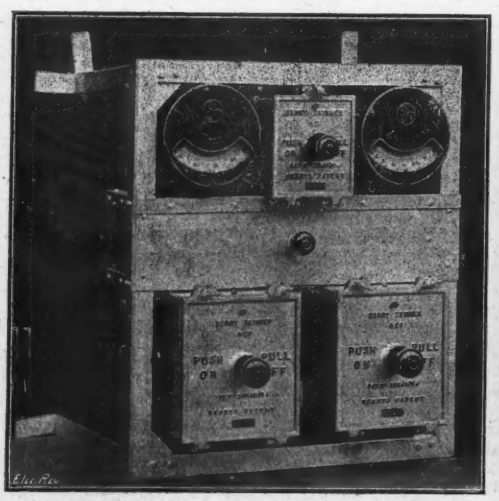

FIG. 25.—IRONCLAD SWITCHGEAR WITH METERS.

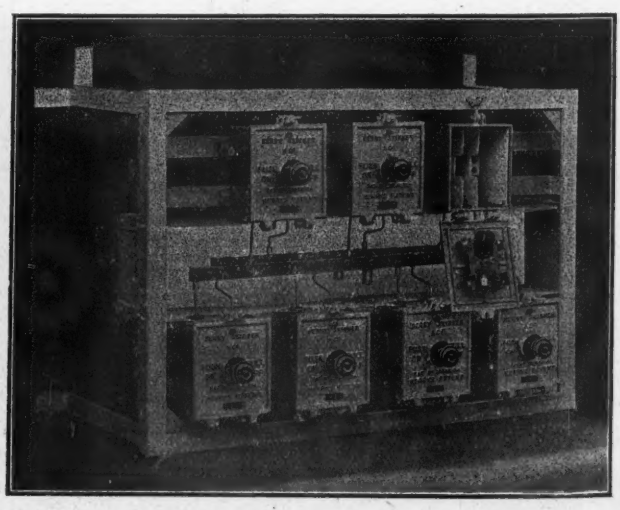

FIG. 26.—SWITCHGEAR WITH BUS-BAR CHAMBER OPENED.

be removed unless the current has first been switched off, are carried on the cover of the case, so that when the latter is opened the fuses and working parts are lifted right out of the oil, and are easily accessible for removal. The cover is provided with means for catching the oil, and it is claimed that the arrangement represents a great advance over types in which the oil-tank is removed, exposing the live contacts and allowing the oil to drip on the ground. The fuses provided are of a special enclosed type, which give very satisfactory results, reducing the carbonisation of the oil and keeping it much cleaner than open fuses; the latter, however, can be substituted in case of need, the length of break being sufficient. The cables are brought in above the surface of the oil. The difficulty sometimes met with in ascertaining whether the oil is at its proper level is entirely absent from this device, which can readily be inspected at any moment; an automatic oil-level detector can be provided if desired.

The apparatus is made for all pressures, and complies with the Home Office regulations, and it is claimed that it is entirely fool-proof.

## BUSINESS NOTES.

**Consular Notes.—Venezuela.**—The British Vice-Consul at Caracas, in a recent report, states that the Tramways Co., of Caracas, is owned by the United Electric Tramways Co. of Caracas, Ltd., with head offices in London. A local company, under the name Compania Anonima Tranvias Electricos, was formed to meet the requirements of Venezuelan law. Working under a 99-years concession from the Venezuelan Government, the service was opened on March 15th, 1908. At present there are about 15 miles of single track, with crossings, gauge 3 ft. 6 in. The company owns 41 cars, and the average car-mileage per day is 2,211 miles. The company is now carrying about 300,000 passengers a month, with a population of between 70,000 and 80,000. The power generated by waterfall about 10 miles from the city, is taken from a local company. The company has a reserve power of three Diesel engines of 240 H.P. each, and in addition a battery capable of carrying the entire load for one hour. It may be of interest to report that the local electric power company referred to is now erecting a new generating station below the one already in use. The fall of the same river will be utilised to run the new station.

**Germany.**—The British Consul at Stettin reports that, during the last five years, electric central power stations have been erected in various parts of the province for supplying electric current to neighbouring towns, villages, estates and farms. The largest station is at Beswitz and controls a network of lines, 116·7 miles in length; the second in size is situated at Lottin controlling 83·2 miles. Two smaller stations, are at Crussow with 4·1 miles, and Schmolsin with 6·8 miles. Additional stations are proposed, or are in course of erection, at Schajow, Belgard and Anklam. These electric works are principally controlled by associations formed by landed proprietors, and sums have been voted by the Provincial Representative Chamber to assist the undertakings. Great importance has been attached to supplying small farmers and artisans living in the country with electric light and power at a cheap rate. Some towns have not been able to overcome old prejudices, but on the other hand, whole villages and small towns have been linked up with central power stations. The steady increase of wages and taxes has compelled farmers to work more economically. Should it, therefore, be possible to increase and develop these stations by means of cheap water-power, the agricultural districts will no doubt greatly benefit thereby. The practical application of electricity has latterly made such progress that in the next few years the cultivation and treatment of agricultural produce will be undertaken by this means. It is already possible to plough and thresh, to saw timber, to clean grain, and to cut turnips and beetroot, by electrically-driven machines, and electricity is also extensively used in dairy farms, distilleries, factories, carpenters' shops, smithies, limestone factories, &c.

**Spain.**—The British Consul at Barcelona reports that the supply of electric light and power in that town is in the hands of two companies, one known as the Barceloness, and the other as the Catalana. The former is a German undertaking. Electric light, although in very general use, is very expensive, the charges being 1 peseta per KW.-hour for current for domestic purposes, and 30 c. for current for power. These prices might be, and probably will be, reduced when some of the schemes at present under consideration for harnessing the water-power which could be obtained by means of some of the large rivers, are carried out.

**Sweden.**—The British Consul at Gothenburg reports that, in spite of the depression under which the electrical industry of Sweden suffered during the past year, many improvements in electrical engineering are to be noted. As to the power industry, the supply of power from one of the largest companies, the Sydsvenska Kraftaktiebolaget, began in the course of the year. The Trollhatten Works, which began their delivery of power in 1908 from the provisional establishment, extended their lines in 1909 to Gothenburg, Alingsas and Skofde, and began supplying the last-named town with power. The Hemsjo Co. set going its new power station at Torsebro during the year. In Norrland only one large power station was opened—viz., Ungers Industri-Aktiebolags power station at Arbra. Stora Kopparbergs Bergslags power station at Bullerforsen is still in hand. The power station of the Uddeholm Co. at Forshult and the Vasterdalalfvens Kraftaktiebolag's power station at Mockfjard have started, and Hellefors Bruks Aktiebolag has begun the harnessing of four of its waterfalls in Svartalfven. The town of Umea has begun the construction of a power station at Klabbole on the Umea River. The large steam turbine station at Gelivare was ready to start work at the close of the year. An association under the name of the Swedish Water Power Association was formed in 1909 for the promotion of a rational use of water power. This association has on its programme several questions of great importance for the economy of the water power, such as better water legislation, control of rivers and lakes, and so on. As to the application of electricity to industry and mining, the smelting of ore by electricity has attracted the greatest attention. In order to study this method thoroughly, the Iron Office has begun the erection at Trollhatten of an experimental furnace.

The British Vice-Consul at Landscrona reports that a complete electrical plant has been erected there, utilising the water power of the river Lagan, some 100 km. away. This new source of light and power will undoubtedly have a beneficial influence on the development of the industry of the town.

The British Vice-Consul at Lulea reports that the proposal for the electrification of certain railways in the district was submitted to the Royal Administration during 1909 for their consideration and report to the King. This report, which is very interesting, concludes by proposing that one of the largest waterfalls on the river Lulea should be harnessed for electric energy. The cost of erecting the proposed power station, which is calculated alternatively for 37,500 and 50,000 turbine H.P., is 9,337,000 and 9,440,000 kroner respectively. The electrical outfit of the power station calculated on 37,500 H.P. would be 11,353,000 kroner, or 11,834,000 kroner on 50,000 H.P. The proposed power station is calculated to be in working order during 1914.

The British Vice-Consul at Hudiksvall reports that a new electric power station has been erected there for about 2,000 H.P., with power from the Arbra Elektricitetsverk, about 33 miles from Hudiksvall. From this station electric power will be distributed to several factories in the town and the neighbourhood, and light to houses if desired. At Forssan (about nine miles from Hudiksvall) a new wood pulp mill of about 15,000 tons production has just been set in operation. The cardboard manufactory at the same place produces about 1,500 tons. Both these mills are now run with electric power from Arbra (about 40 miles from Forssan). The sulphite mill at Ström (about 15 miles from Hudiksvall) is enlarged for a production of about 14,000 tons. To facilitate discharge and transport of coal and chemicals for this mill an electric derrick crane has been erected at Stocka, and an electric railway has been built between Stocka and Ström.

The British Vice-Consul at Gefle reports that the Stora Kopparbergs Bergslags Aktiebolag, of Harnas, are just completing a large power station at the Buller waterfall, near their ironworks at Domnarfvet, near Falun. The company expects to obtain about 24,000 H.P. to be used partly for the driving of the large paper mill at Qvarnveden, close by, and partly for the generation of electricity for the smelting of steel at Domnarfvet. The electric smelting furnace at which Swedish and other engineers and chemists have been working for several years, is said now to be technically and commercially successful.

**Mexico.**—The British Consul at Vera Cruz, in a recent report on the trade of his district, states that it is gratifying to note that the Mexican market is receiving more and more attention at the hands of British exporters, with the result that during the last two years, especially in the city of Mexico, several British firms have decided on opening offices in order to get the benefit of direct representation, generally conceded to be the only way not only to further expand but to hold such trade as we have, with the desperate competition of modern times. British firms, it is alleged by those who have resided any length of time in this country, have had considerable difficulty to contend with through not having direct representatives, but there is no question that British machinery especially is making great headway. Neither is it confined to any one particular branch, but it would seem that the excellence of the work of our manufacturers is becoming more appreciated by the Mexican public at large. The fact that British capital was largely invested in Mexico while its management was not in the hands of British subjects, has been a handicap against which to contend, as it was only natural that managers of other nationalities would prefer to place their orders where they have always been accustomed to, instead of giving these to a British firm for a type of a machine strange to them. In general the catalogue as a means of obtaining trade is of very little value, the more so when only 1 or 2 per cent. of the catalogues that reach the Consulate are printed in Spanish, the balance being purely in English, with English weights and measures and values. Possibly it would be argued that it would be as expensive to introduce catalogues printed in Spanish, and with weights and measures calculated on the metric system, as it would be to introduce the goods themselves. Catalogues are useful in following up an established trade, but their initiatory power is very small, except when distributed by the personal representative of the manufacturer. The traveller readily learns the needs and requirements of a country, and he can very often obtain as a new-comer a good deal of information by a visit to Consular officers in the different districts. The catalogue is a mere matter of chance—the traveller produces lasting and permanent returns.

Some exporters seem to have the idea that postage rates are equal all over the world, and a very serious cause of complaint on the part of merchants in Mexico is that a great number of letters coming from the United Kingdom bear only 1d. stamp, with the result that the addressee is compelled to pay a postage penalty of 5d. for every half ounce or fraction thereof, which causes a good

deal of irritation, especially as it is repeated time after time, even when the receiver has gone so far as to send back an envelope, and an intimation of the oversight. The same error is frequently made also in posting bulky advertising matter, all of which creates a bad impression, especially in the case of one endeavouring to open up trade relations by means of correspondence and catalogues.

The British Vice-Consul at Chihuahua reports that British capital has been invested on the Conchos River, near Santa Rosalia, for the purpose of impounding the water of that river by a great dam, and to develop some 30,000 H.P. for the mining districts of Naica, Almobya, Parral, Santa Barbara, and adjoining places. The preliminary work is now under way. The State offers to capitalists who are interested in mining or industrial enterprises great opportunities for investment. It has waterfalls for electric power, and great resources in minerals.

The British Vice-Consul at Guadalajara reports that an amalgamation of power interests has resulted in the formation of the Chapala Electric and Irrigation Co., with a capital of 14,000,000 Mexican dollars. The Federal Government lends the company $3,000,000 for the construction of a dyke to be built across a portion of Lake Chapala, which will be the first step towards reclaiming about 123,500 acres, with a value of $12,500,000 (£1,250,000). It is estimated that about 490,000 acres can be irrigated by Chapala water when the plans of the company are carried into execution. In addition to its importance as a factor in irrigation the company has concessions which will enable it to produce over 100,000 H.P. of hydro-electric energy from the Santiago river, which is an effluent from Lake Chapala. It is noteworthy that power sells at from $100 to $125 per horse-power per annum. Mining districts will aborb a fair amount of power in the Hostotipaquillo and other camps. The Chapala Electric and Irrigation Co. will naturally supply Guadalajara with power, and a contract has lately been signed to run transmission lines and power to the city of Aguascalientes, while it is possible that power may also be carried to Zacatecas. The machinery for the large power plants of the company is being supplied by contract. Few cities will enjoy cheaper or more abundant power than Guadalajara, which seems, therefore, to be destined to be the seat of great manufacturing interests in the future.

**Japan.**—The British Vice-Consul at Dairen (Port Arthur) reports that there was there a power of 1,560 KW., of which 400 KW. was required for the electric tramway. The supply is not yet equal to the demand, and applications for installation continue to be refused, but with the addition of 2,000 KW. in the course of 1910 the power house will be able to meet all calls. The number of lights has now reached 16,000. Of the machinery ordered in 1909 and to be laid down in 1910, the generators and engines are of American make, while the boilers, rotary converters and steam condensers have been purchased in the United Kingdom. At Changchun all the plant was laid down and the settlement was lighted from the beginning of 1910. At Mukden there is to be a further extension during this year, and the engine, boiler and dynamo have all been ordered from the United Kingdom. The lamps used by the company throughout are of German make, the fittings being supplied locally. The tramway system in Dairen was completed and opened in September, 1909, the total length of the track being 14 miles. At first the cars were being run at a loss, but it was hoped to remedy this in the spring. The rails and 40 of the cars came from the United Kingdom, 10 cars were made in Japan, while the motors, wires and poles were supplied by Germany. An extension of 3½ miles may be made in 1910.

**Turkey.**—The British Consul at Beirut reports that the gas company in that town have acquired a concession for electric lighting works, and are importing their plant from Europe. They have begun the construction of their workshops, and hoped to have things in working order by July of this year. The tramway company (Belgian) continues to work satisfactorily from the point of view of the public, but it seems doubtful whether it will prove very profitable as an enterprise.

**China.**—The British Consul at Chungking reports that a Chinese company has been formed with a capital of $300,000 (£25,000) for the purpose of lighting Chungking with electricity. Machinery and equipment have been obtained from Europe, and a foreign engineer has been engaged in erecting it. It was expected that the work would be completed by August of this year. The equipment as at present arranged will be capable of lighting 8,000 carbon-filament 16-C.P. lamps, or about 16,000 metallic-filament lamps. A movement is also on foot to install electric light in Chengtu, and a company was promoted for the purpose during 1909. Apparatus was purchased in Europe, and sales on a small scale with about 100 lamps began in February, 1910.

**France.**—In a recent report the British Vice-Consul at Lille calls attention to the difficulties experienced at the Customs by importers of machinery since the new Tariff came into force, on April 1st of this year. To avoid trouble and fines the following rules should be observed: (1) On declaration at the Customs a plan or drawing of the machine must be produced; (2) the weight of the machine must be given very exactly; (3) extra change pieces should be packed apart from the machine and declared separately.

The British Vice-Consul at Grenoble reports that the products of the local electro-metallurgical industry in 1909 were as follows: Ferro-chrome, 1,500 tons; ferro-silicium, 3,000 tons; spiegel, 1,000 tons; carbide of calcium, 10,000 tons; steel, 15,000 tons.

**Denmark.**—The British Consul at Copenhagen reports that the use of the telephone in Denmark has become general with extraordinary rapidity. Not to find a telephone in the towns or even the country districts is the exception rather than the rule. Whereas in 1881 the telephone company of Copenhagen had only 22 subscribers, it now numbers some 33,000. This rapid increase has not been confined to Copenhagen alone, but has spread to the provinces, and Denmark, comparatively speaking, now possesses the most extensive telephone service of all European countries, having 33·2 telephones per 1,000 inhabitants, whereas Sweden has 31·7, Norway 23·3, Switzerland 22·8, and Germany 14·1.

Later in his report the Consul states that large electrical works are at present being planned in Jutland, in the district between Aarhus and Randers. The scheme embraces not only an electric railway between these two points and the eventual establishment of branch lines, but also the supply of electricity to the whole district both for household and for industrial purposes. A scheme on much the same lines is also proposed for Lolland and Falster by establishing a large central power station at or near Marlbo.

**Norway.**—The British Vice-Consul at Bergen reports that foremost among the new industrial projects in the district must be placed that of the electric smelting of iron and steel. As far as he can ascertain, two processes have been tried in Western Norway. One of these is described as the method employed by the Noble Electric Steel Co. in California, and is stated to have been tried at some smelting works at Trondhjem. The other method is the Grönvall process, and a company is being formed for the erection of electric iron and steel smelting works near the growing industrial centre of Odda, in Hardanger, the necessary electric power to be supplied by the Tysse Falls Co. in that neighbourhood. It is stated that this undertaking will probably prove of great importance for the utilisation of Norwegian low-grade ores. Work has been progressing apace with the Bergen municipal water-power electric works at Samnangar, situated to the east of Bergen, for the purpose of supplying power for lighting and industrial purposes in this city, which is at present dependent on steam power electric works. The work includes the blasting of a water tunnel over 2 miles long, which, it is estimated, will take two and a half years to complete. The power station is to contain machinery for 35,000 H.P. The current at 7,500 volts is to be transformed up to 40,000 for transmission to Bergen. The six cables are to be about 22 miles long, and the works are to be completed by the first half of 1912, at an estimated cost of about £200,000.

**Book Notices.**—*Radio-Activity.* By Guy Stephen, D.Ph., Lond. London: Van Alexander & Co. Price 1s.—This is a brochure specially compiled for MESSRS. SIEMENS BROS. & CO., LTD., on the basis of the work of the most eminent authorities, for the purpose of assisting medical men interested in the therapeutical applications of radium to arrive at a general understanding of the treatments now in vogue, and of the lines on which they can proceed. It is in no sense a trade pamphlet, the contents being devoted wholly to the scientific and therapeutic aspects of the subject, dealt with in simple language and methodical order. The extraordinary curative properties possessed by radium salts, even in infinitesimal quantities, are lucidly outlined, and the book forms an admirable introduction to a subject of the first importance, and, in spite of its associations, the utmost simplicity.

*Practical Measurements.* By A. W. Siddons, M.A., and A. Vassall, M.A. Cambridge: The University Press. Price 1s. 6d.—This book contains instructions for a series of experiments in weighing and measuring, designed to bring mathematical and science teaching into closer relationship, and based upon a report of the Mathematical Association and the Association of Public School Science Masters, on "The Correlation of Mathematical and Science Teaching." The experiments require only simple apparatus, and can, for the most part, be carried out in a room without special equipment. The instructions are explicit, and the results are to be entered in spaces left blank for the purpose. Important principles, when proved by experiment, are brought out in bold type, The illustrations and get-up of the book are of the highest quality.

*Transactions* of the South African Institute of Electrical Engineers. Vol. I, Part 8. July, 1910. Johannesburg: The Institute. Price 2s.

"Elementary Manual on Applied Mechanics." By Andrew Jamieson. Ninth Edition. 1910. London: Charles Griffin & Co. Price 3s. 6d. net.

"Illustrita Technikal Vortolibri en sis Lingui." No. 1, 1910 Munich: R. Oldenbourg. Price M. 1.

"Tariff Reform as a Means of Raising Revenue." By the Rt. Hon. A. Ure, M.P. 1910. London: Cassell & Co. Price 1d.

"Boletin Technologico de la Association de Peritos Industriales." September, 1910. Madrid: Fuencaral, 9.

**Catalogues and Lists.**—MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Small card showing a new pattern of their Spookie night watch lantern, which is made square, instead of round as last year. No glue is used in the fixing of the roof piece, so it does not come apart because of the heat of the lamp. The framing is made up of specially thick card, which in appearance closely approximates to wrought-iron.

THE ADNIL ELECTRIC CO., LTD., Adnil Building, Artillery Lane, London, E.C.—36-page illustrated price list No. 125E, containing a full description of their type S F direct-current motors with interpoles, accompanied with tabulated prices, weights, voltages, outputs, &c.; also particulars of various types of metallic starters and regulators for pressures up to 550 volts. The motors have been specially designed to meet the demand for motors suitable for driving machine tools where a wide range of speed regulation is required, or for driving high-speed turbine pumps, where, on account of unfavourable commutating conditions, the use of ordinary motors is excluded; also for use where considerable overload capacity is required in the case of heavy intermittent service. The list gives for each range a very large number of outputs, and shows the normal and maximum speeds within the limits of which these motors can be made.

MESSRS. MEDWAY'S SAFETY LIFT CO., 10, Bush Lane, London, E.C.—12-page booklet on electric lift control gear, describing, with a number of appropriate half-tone illustrations, the automatic and semi-automatic push-button systems, car switch control, and hand rope control, with special reference to the firm's special and patented types improved as the result of long practical experience in electric lift design and installation.

THE BRITISH PROMETHEUS CO., LTD., Salop Street Works, Highgate, Birmingham.—New circular (No. 140) relating to their electric cooking apparatus giving a number of neat illustrations and brief notes thereon. This list has been prepared for circulation by electrical contractors and others in business-getting. Quantities can be obtained from the firm free of charge.

"Meter-reading by the Petersen System" is the title of a booklet issued by MESSRS. BEN JOHNSON & CO., Micklegate, York, containing a reprint of Mr. J. C. Petersen's article on "Meter-reading Books and Consumers' Ledgers," from our issue of January 1st, 1909, together with full prices and particulars of the cards, card cases, binders, cabinets, and other accessories required for the purpose. The company, who inform us that they have given attention to the system for many months, will send a copy of the booklet to any of our readers who may be interested in the subject.

MESSRS. SIEMENS BROS. & CO., LTD., Caxton House, Westminster.—List No. 529 gives illustrated descriptions and prices of electric motor sirens. Catalogue No. 528 (20 pages), "Electric Bells and Accessories," contains a variety of domestic bells of all qualities and finishes. In some of the inexpensive patterns the frame is of wrought-iron stamped in one piece. Some special lines of indicators, with unique moulding, in three qualities, each for pendulum and mechanical types, are included; also watertight electric bells, with diaphragm device, for outdoor and mining purposes, pushes of all varieties, contacts and small switches.

THE WITTON-KRAMER ELECTRIC TOOL AND HOIST CO., Witton, Birmingham.—New 24-page fully illustrated list showing and describing their electric hoisting and transporting appliances, suspension hoists, mono-rail electric hoists and travelling cranes, electric spur-geared hoists and transporters, electric friction winches, hand and power travel electric hoists, electric capstans and lifting magnets.

THE WESTINGHOUSE COOPER HEWITT CO., LTD., 151-2, Great Saffron Hill, Holborn Circus, E.C.—Four-page list, No. 13, dealing with their mercury vapour converters, mentioning their purpose, principle, and action, &c., and giving prices and weights of bulbs, and figures of comparative cost of charging accumulators.

THE SUNBEAM LAMP CO., LTD., Park Road, Gateshead.—We have received an advance copy of the Lamp Section of this company's new catalogue. In the course of 20 pages, illustrations and tabulated sizes, consumptions and prices, appear of Sunbeam metal and carbon-filament standard lamps. The company emphasise the fact that their metal lamp is of British manufacture throughout, being made—including the glass bulb and the tungsten filament—at their works at Gateshead. A special feature of the present list is the inclusion of new carbon and metal-filament battery lamps which are specially adapted for motor-car work.

MESSRS. TETLEY & CO., Falcon Electrical Works, Bedford Street, Greengate, Salford.—A number of new illustrated price lists have just been issued, as follows:—No. 35, relating to the standard type "Falcon" motor-starters; No. 36, combined starters and shunt field regulators; No. 37, starter regulators for series and shunt-wound motors; No. 38, cinematograph resistances; No. 39, shunt field regulators for generators and motors. Prices and capacities are plainly set forth in table form in all the lists. Also list No. 40 (eight pages), fully describing with half-tones, and diagrams of dimensions, their handle type oil break switches, with tables of prices showing these for voltages up to 600, and thence up to 3,000, as follows:—Without automatic overload release; with overload release on two phases; with overload release on three phases; and with automatic no-volt and overload release.

MESSRS. DONOVAN & CO., 12, Barwick Street, Birmingham.—Small leaflets relating to replacement fuses and fuseboards.

MESSRS. EVERETT, EDGCUMBE & CO., LTD., 117, Victoria Street, London, S.W.—Card intended to draw attention to their electrical instruments. The material on the card consists of 10 appropriate humorous illustrations by Hassall.

MESSRS. W. F. DIXON & CO., 60, Percival Street, C.-on-M., Manchester.—New circular drawing attention to, and illustrating, their specialities in buffalo raw hide and waterproof paper gears. The firm have made alterations and extensions to their plant which enable them to make machine-cut gears of every description.

MESSRS. TAYLOR & CO., 40, Hatton Garden, London, E.C.—Leaflet illustrating a number of their bead shades for electric light, and stating prices of same.

MESSRS. OZONAIR, LTD., 96, Victoria Street, London, S.W.—Twelve-page pamphlet fully describing with illustrations, weights and dimensions, prices and code-words, their Ozone apparatus specially adapted for laboratory and research work. Some full diagrams of different arrangements for use of the apparatus on small and large scales respectively, are given.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., Caxton House, Westminster, S.W.—Well bound catalogue of close upon 300 pages devoted entirely to electrical supplies. The various sections are indicated by a thumb index, with a key at the front of the book. The publication is of handy size, and considering the amount of matter contained in it, is less bulky than one would think. Small illustrations and a compact arrangement of matter, blocks and tabulated prices, have made this possible. Our readers may judge of the contents of the book from the following titles of the various sections: Tantalum lamps, carbon-filament lamps, arc lamps and carbons, installation accessories, conduits and conduit fittings, fittings (parts, adaptors, hand and standard lamps, pendants, electroliers, tantalum arcs, brackets and ceiling fittings, radiators, weatherproof, waterproof and street fittings), reflectors and holophane ware, wires and cables and "Stannos" wires, switches, switchboxes and fuses, circuit breakers, lightning arresters, instruments, instrument transformers and meters, electric heaters and cookers, electric bells, wires, pushes and cells.

THE CONCORDIA ELECTRIC WIRE CO., LTD., Crown Parade, Cricklewood Lane, London, N.W.—Pocket tables of H.C. copper wires and high-resistance wires; price list of silk and cotton copper H.C. copper wires and high-resistance wires (bare and silk covered); leaflet giving prices of "Resistin" high-resistance metal; also price list of the "Hot Point" electric iron.

**Liquidations.**—Under a compulsory winding-up order made against the Mid-Oxfordshire Gas Light and Coke Co., Ltd., 18-19, Ironmonger Lane, E.C., the statutory first meetings of the creditors and shareholders were held on September 23rd, at the London Bankruptcy Court, Mr. H. M. Winearls, Official Receiver, presiding. The company was incorporated on October 10th, 1905, with a nominal capital of £50,000 divided into 2,500 preference shares and 2,500 ordinary shares, all of £10 each, its objects being to acquire several gas undertakings with a view to economically working the same under one management. The company was nominally promoted by the Finance and Construction Co., Ltd., the actual promoter being E. O. Preston, who also practically controlled the company's operations throughout. The company purchased gas works and undertakings at Bicester, Woodstock, Chipping Norton, Bampton and Eynsham, Shipton-under-Wychwood, Charlbury and Highworth, payment being made in cash and debentures. A Bill was presented to Parliament in which the company asked for special powers with regard to its undertaking. The Bill was considered by a Select Committee of the House of Commons, and on May 4th, 1906, rejected on the ground that the finances of the company were unsatisfactory. On June 24th, 1909, the company purchased the Chipping Norton and District electric lighting undertaking for £10,500, which was satisfied by the issue of £7,000 special debentures carrying a first charge on the undertaking and ranking with the debenture stock in regard to any deficiency, and by the issue of fully paid preference shares for the balance, viz., £3,500. No agreement has been filed with the registrar of joint stock companies in respect to these fully paid shares. The directors state that the electric lighting works were purchased by the company in order to abolish competition. The company's engineer, Mr. A. F. Painter, recommended the purchase at £10,500. The company's trading resulted in a net profit of £179 from the date of incorporation until June 30th, 1908, but in a net loss of £4,145 during the ensuing two years. The failure of the company is attributed by the directors to the inability to obtain statutory powers, and shortness of working capital. In the opinion of the Official Receiver it is also due to over-capitalisation and inefficient management. Mr. R. W. Thornton, chartered accountant, Oxford and London, was elected to act as liquidator, assisted by a committee of inspection. The accounts filed under the liquidation showed total liabilities £80,449, of which £58,530 is due to debenture-holders; assets valued at £60,302; a deficiency of £19,796 in assets to meet the liabilities; and a total deficiency of £34,501 as regards shareholders.

EASTON LIFT CO., LTD.—A meeting is to be held at Express Works, Short Street, Southwark, S.E., on October 31st, to hear an account of the winding up from the liquidators, Messrs. G. H. Ide and L. Phillips.

**Norway.**—An American Consul, in reporting upon the position in Norway, says:—"The remarkable growth of Stavanger in population and in commercial importance in the past few years, the recent installation of its large water-power electric plant with the resulting demand for electrical apparatus, the city's steady tendency to adapt itself to the conditions of life of the modern city, have all tended to create and stimulate a demand for the best modern inventions, machines, house furnishings, office and factory equipment. Probably the chief difficulty in selling American machines in Norway, especially the more complicated, such as automobiles, motor-cycles, typewriters, motors, and some electrical apparatus, is the difficulty in securing renewal parts when the machine needs repairs. The distance from the factory, the slowness of communication and transportation, and the fact that, in many instances, the machine remains at a standstill until replace parts can be secured from America, make this a serious problem, and result in the local customer hesitating long before buying American machines of this class. This fact has given those American firms having branch factories in Europe a great advantage over other American manufacturers."

**Brussels Exhibition Award.**—The London agency of DR. HEINRICH TRAUN & SONS informs us that the works in Hamburg have been awarded the Grand Prix for their exhibits at the Brussels Exhibition.

**Car Lighting.**—Last week MESSRS. C. A. VANDERVELL AND CO., of Acton Vale, gave a demonstration of their new "C.A.V." system of lighting motor-cars with a variable-speed dynamo, which has been brought to a high degree of perfection and simplicity. We hope to describe it in an early issue.

**Canada.**—THE CANADIAN WESTINGHOUSE CO. is preparing to build an addition to its plant at Hamilton, Ontario, at a cost of $22,000. This is one of a series of additions which will cost together about $100,000.—*Commercial Intelligence.*

**Trade Announcements.**—With reference to a notice appearing under this heading in our last issue, we are asked to state that Mr. T. W. Vaughan was not works manager of the Vaughan Engineering Installations, Ltd.; he was one of the first directors of the company, as will be seen from the registration announcement published in the Electrical Review for June 18th, 1909, page 1013. Mr. Vaughan has now started business as T. W. Vaughan & Co., electrical heating and ventilating engineers, with offices and showrooms at Cross Street, Islington, and works at Fowler Road, Islington.

The Abbey Electric Co., 17, Victoria Street, London, S.W., announce that their telegraphic address and telephone number have both been changed. The former is now "Lightsome, London," and the latter "4,027 Victoria."

Messrs. W. V. Waite & Co., Ltd., engineers, contractors, &c., Gordon Chambers, 31, Queen Street, Cardiff, have just been appointed agents for the South Wales district for Messrs. Bruce Peebles & Co., Ltd., Edinburgh.

Messrs. Ingram & Kemp, Ltd., of Birmingham, who are well known in the world of gas fittings, have just opened a showroom in a new building at 26 and 27, Hatton Garden, London, E.C., for the display of a large variety of electric light fittings and radiators that they are now prepared to put before the electrical trade. An inspection of these manufactures is invited, and lists are in course of preparation.

Messrs. Ruberoid Co., Ltd., head offices, 81-83, Knightrider Street, London, E.C., have recently completed an extensive factory at Brimsdown, Middlesex, for the manufacture of Ruberoid roofing, damp-course, flooring, sarking felt, insulating papers, insulating varnishes and the well-known P. & B. tapes. The materials manufactured by this company are known throughout the electrical industry, particularly the P. & B. insulating varnishes and P. & B. tapes. The company have recently brought out a 16-page catalogue (No. 124) of preservative paints, which, with full sets of samples of all materials manufactured, and catalogues, will be sent to those particularly interested in the matter.

**Private Meeting.**—George Cohen (trading as the Premier Electrical Co.), 212, West End Lane, Hampstead, N.W., and 4, The Promenade, Golder's Green.—A meeting of the creditors in the above matter was held last week, when a statement of affairs was submitted showing liabilities to trade creditors £771, and partly secured creditors £700, less security, £340-£360, making the liabilities total £1,131. The assets totalled £272, and after allowing for the claims of the preferential creditors, £141, there were net assets £131, the estate thus showing on paper a deficiency of £999 14s. It was reported that the debtor started business 10 years ago in Mile End with £40 capital, and in 1909 took his present premises at Hampstead and Golder's Green, on which he has spent a fair amount in respect of fixtures. The partly-secured creditors are the debtor's uncles, who have at various times lent him money. About 10 days before the meeting they advanced him £50 in respect of certain wages, and the debtor thereupon assigned to them all his book debts, amounting to about £340. One creditor had levied execution, and at the date of the meeting was in possession. The household furniture was made over to the debtor's wife about two years ago under a marriage settlement. An offer was made by the debtor's solicitor of a composition of 4s. in the £, payable within four months, but the creditors considered this offer inadequate. Some discussion took place, and it was eventually resolved to confirm the deed of assignment in favour of Mr. G. E. Corfield. A committee of inspection was also appointed, consisting of the representatives of the General Electric Co., Ltd., Messrs. Peyton & Peyton, Ltd., the Foster Arc Lamp Co., Ltd., and the Times Electrical Co.

**Holophane Reflectors.**—Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E., inform us that they are now in a position to take orders for holophane stiletto reflectors. They will be supplied in three types, namely:—Type E or extensive, *i.e.*, distributing; type I or intensive, *i.e.*, concentrating; type F or focusing, *i.e.*, very strongly concentrating. These are supplied in various sizes, the price for each size being the same whether type E, I, or F is ordered. Stocks are held of all sizes up to and including No. 100 (25, 40, 60, 100), and it is hoped that the 150 and 250 sizes will be ready shortly. Messrs. Siemens are preparing literature regarding these specialities. The reflectors will be supplied with crinkled or plain edges.

**Large Haulage Motor.**—We learn that Messrs. Ernest Scott & Mountain, Ltd., of Gateshead, have recently received an order for a large haulage motor for Murton colliery. This motor is to be operated on 3,300-volt 40-cycle supply taken from the Newcastle Electric Supply Co., and is for operating a 400-h.p. haulage gear. The motor is of a special type which this firm have recently introduced with windings specially designed to withstand the heavy overloads which are usual in work of this class.

**Bankruptcy Proceedings.**—Frederick Peacock, 59, North Station Road, Colchester, Essex, electrician.—The receiving order herein was made on the debtor's own petition, and according to the accounts filed, the ranking liabilities amount to £226, to meet which there are no assets. The debtor states that he has carried on business in Colchester for nine years, but has never had any business premises. He started with about £57 clear. He states that if he obtained a job to install electric light, he always went to one particular firm for the goods he required, which were to be supplied at 10 per cent. above wholesale prices, and in addition, up to November last he did all the electrical work for that firm, and against the work he did for them the arrangement was that they were to set off goods had from them by the debtor for his own jobs. The debtor states that no money has passed between the firm and himself, and that he has had no goods from them since November. The firm claim to be creditors for £235, but he thinks they ought to give him credit for a sum of about £85, which he expended on labour in connection with their work, and has only returned them as creditors in his statement of affairs for £150. The major portion of the other creditors are for goods supplied and work done. The debtor says that he has no assets, the furniture in his house belonging to his wife and three sisters. He says that his wife bought most of the furniture, and some of the things were given to her by his mother. The debtor attributes his failure to not earning enough to pay his way, and illness of family, and he admits that he has known of his position for some years, but says that up to November last his only creditor was the firm previously referred to, and they knew his position. The other debts have been contracted since November.

**Worthington Pumps and Condensers.**—Among the orders recently received by the Worthington Pump Co., Ltd., are the following:—

Three sets of Worthington triple-expansion pumping engines, with boilers condensers, feed pumps, piping, &c., for Maikop Oil Fields.
Complete surface-condensing outfit for 42,000 lb. of steam per hour, for the Coventry Electric Light Station; for 25,000 lb. steam per hour, for Southwark Electric Light Station; for 20,000 lb. steam per hour, for Stretford Electric Light Station; and for 10,000 lb. steam per hour, for Northampton Electric Light Station.
Five complete jet condensing, barometric and low-level outfits, also cooling tower for colliery and ironworks service in the Midlands.
Two special patent oil separators, one to deal with 80,000 lb. exhaust steam per hour and the other to deal with 36,000 lb. exhaust steam per hour.
Condensing outfits for the Urban District Council of Pontypridd, and for the Belfast Harbour Commissioners.
An order for 870 Worthington water meters, for the Calcutta Municipal Waterworks.

Besides the above, a large number of orders have been booked for their duplex pumps, amongst them being over 60 for marine service, also centrifugal and turbine pumps up to 200 h.p. per unit.

## LIGHTING and POWER NOTES.

**Acton.**—At a meeting of the Acton D.C. on Tuesday evening, the deputation appointed to meet the Metropolitan Electric Supply Co., Ltd., with reference to the handing over to them of the Acton electricity undertaking, recommended the Council to agree to the company at their own expense applying for Parliamentary powers to enable the undertaking to be transferred to them for a period of 42 years, the transfer to provide that if the Acton Council decides to exercise its power of repurchase under the Electric Lighting Act of 1888, it shall give the company five years' previous notice in writing. The Council was recommended that there be a covenant that the Metropolitan Electric Supply Co. pay the Council from time to time such sums as would be necessary to enable the Council to pay the annual interest and sinking-fund charges on the loans contracted, subject to certain provisions in regard to street lighting. It was further stated that with regard to the capital expenditure incurred by the Council on street lighting, the company would pay the interest and sinking-fund charges thereon only if the Whiley Council contracted with the company to continue to use electricity for street lighting purposes to at least the same extent as at present. The report, which contained other recommendations, was moved by the chairman (Councillor H. S. Schultess Young), and Councillor Glen proposed that the terms proposed by the deputation, as contained in their report, be declined as unsatisfactory to the ratepayers and consumers of Acton. On being put to a vote, the amendment was carried by 12 to 10 votes, and on being put as a substantative motion, it was passed by 12 votes to 11. Councillor Hamilton then proposed, and it was agreed, that the deputation be requested to obtain a revision of terms from the company. This having been passed, three more members of the Council were added to the deputation.

**Ainsworth (near Bury).**—On 26th inst. this village was lighted up along the main streets and surrounding country lanes for the first time, electricity being used. There are about 80 lamps of 50 c.p. installed, current being supplied by the Lancashire Electric Power Co.; the cost per lamp per annum is about £2 12s.

**Aldershot.**—The U.D.C., on September 21st, decided to extend the lighting mains in Queen's Road in order to supply the new business premises being erected by Messrs. Miles & Miles, house furnishers.

**Ballachulish.**—The scheme of electric haulage and pumping at the very extensive slate quarries of Ballachulish, in Argyllshire, has now been completed. Two suction gas engines form part of the motive power equipment. The British Electric Plant Co., Ltd., Alloa, carried out the contract.

**Barking.**—The report of the electrical engineer upon extensions to the generating station has been considered in committee.

**Bath.**—The new technical institute which has just been opened, at a cost of £4,500, was completely fitted out electrically by Messrs. Lambert & Sons, a local firm. In all there are 100 lights.

**Bedford.**—The T.C. has decided to extend the mains so as to supply current to the Working Men's Club, Russell Street, the Ampthill Road Maltings and the Igranic works of Messrs. Adams. The latter firm guarantee an annual revenue of £60 for three years.

**Belfast.**—A Sub-Committee of the Corporation Tramway and Electrical Committee, in conjunction with Mr. T. W. Bloxam, city electrical engineer, is making arrangements for holding an Electrical Exhibition in the Ulster Hall in January next. The Exhibition will be arranged on somewhat similar lines to the recent Exhibition of gas appliances for lighting and heating, which was also held under the auspices of the Corporation in the Ulster Hall.

**Blackpool.**—At the refuse destructor works of the T.C. another 40-H.P. motor is to be installed for driving the mortar mills, clinker crusher, tin compressor, fish offal disintegrator and other plant.

**Bolton.**—For the year ending March 31st, 1910, there was a gross profit on the electricity department of £34,941, as against £33,186 in the previous year. The cost of new meters and contributions to defray outlay on Duncan Street sub-station amounted to £1,454. Interest and depreciation charges absorbed £27,811. Against the depreciation and renewals fund account, £11,088 was charged, leaving a credit balance on this account of £21,474. £6,500 was put to the relief of the rates. There were 915 motors in use, and the number of consumers was 2,628.

**British Columbia.**—The *Canadian Engineer* of September 15th contains the following:—"Vancouver, B.C.—On an inspection trip, which will occupy two or three months, J. Buntzen, a director and formerly manager of the British Columbia Electric Railway Co., in Vancouver, has reached here from London, England. Mr. Buntzen will report to the board in regard to present and future extensions and improvements, including the project for the development of 100,000 H.P. at Chilliwack and Jones Lakes at an estimated expenditure of $10,000,000."

**Canada.**—Our correspondent at Ottawa writes:—"A subject of much importance to Canadian municipalities with undeveloped water-powers is the export of water power. In this connection it will be noted, on the authority of the inland revenue department, that of the power in use developed by the Canadian Niagara companies, 85 per cent. is exported and nothing paid to the country that produces it. Of the nearly 400,000 H.P. developed at the Falls, only about 36,000 H.P. is used in Canada, the remainder being used to build up industries in the States. Some day in the near future we may want this power for our own development, and then the cry of vested interests will be raised, and; if we insist on no longer permitting the export, what a problem our Government will have to face and still keep international peace.

"Now is the time to prevent any increase of this difficulty. Let us retain our power or get revenue for it, commensurate with its value, and not be furnishing cheap power to stop our own industrial progress. The experience of Fort Frances, Ont., should be a lesson to all other municipalities. On the United States side of the falls stands a large paper mill which gets its power from the town of Fort Frances, when Fort Frances should be using the power to drive a paper mill of its own. The Government, without ever asking the municipality, gives the power company the right to export its power.

"The granting of permission to the Minnesota Power and Canal Co. to divert water from the Birch Lake basin at the Roing River water shed into the St. Louis river may seriously affect the flow of water in Winnipeg's new power plant at Point du Bois. With a view to protecting the city in this matter, the Board of Control has forwarded to the International Waterways Commission a request that the permit be held up until the effect of the division on the Winnipeg River can be estimated, The city's power engineers are trying to grasp the full significance of the permit, and will report as soon as possible to the city, when more definite action will be taken."

The *Times* correspondent at Toronto says that the "consummation of the Provincial Government's hydro-electric power policy, by which most of the communities in the older part of Ontario are being furnished with motive energy from Niagara Falls, will be celebrated in Berlin early next month. The proceedings will take place in a brilliant electric illumination, and at a banquet addresses will be delivered by Sir James Whitney and Mr. Adam Beck, under whose supervision the enterprise has been carried through."

**Chatham.**—The proprietors of the Theatre Royal have entered into a contract with the Kent Electric Power Co. for a supply of current to augment that generated on the premises. The additional supply is needed for the modern requirements for scenic effects on the stage.

**Chelmsford.**—The B. of G. has decided to install power-driven machinery at the workhouse laundry, at a cost of £560.

**Continental Notes.**—TURKEY.—The Reuter telegram from Constantinople on September 23rd, announcing the acceptance of tenders of Hungarian and French syndicates for the erection of electric supply works in the Turkish capital, was anticipated by a statement made by a Buda-Pesth correspondent of a German newspaper on September 16th. According to the correspondent, the Ganz Electricity Co. proposes at a very early date to put in hand the preliminary works for the electric lighting of Constantinople as awarded to the company. The agreement concluded with the company was altered at the last moment, in so far that at the wish of the Turkish Government a French syndicate is to participate jointly with the Ganz Co. in the financial execution of the scheme.

RUSSIA.—The first electro-metallurgical works in Russia have just been completed by the Compagnie Electro-Metallurgique de l'Oural; they are situated in the Government of Oufa, near the station of Berdiach, and are intended for the manufacture of special pig-iron, and more particularly high percentage ferro-chrome and ferro-silicon intended for use in connection with the manufacture of steel for armour-plates, projectiles, &c.

GERMANY.—The municipal central electric lighting station in the town of Schweidnitz is about to be extended at an estimated cost of £25,000.

SPAIN.—Permission has been granted to D. José Riestra Lopez, Marqués de Riestra, to occupy public lands in Freixa, Caramiñal, for the purpose of establishing an electric power station.—*Board of Trade Journal.*

SWEDEN.—The largest generating station in the south of Sweden, deriving its motive power from the River Lagan, was inaugurated in the presence of the King on the 17th ult. The plant has a capacity of 23,000 H.P., and cost about 10 million kroner. The transmission line is 188 km. in length, and will supply a number of towns and districts.

**Dundee.**—Mr. G. C. Brown, the assessor, has now adjusted the valuation on the Corporation's electricity undertaking, the adjustment come to being that of reverting to an agreement made with Mr. Richardson, the engineer, six months ago, subject to a valuation on further expenditure since that date.

**Dunster.**—The Minehead Electric Supply Co., Ltd., have applied to the B. of T. for permission to use overhead mains for the supply of current at Dunster.

**East Ham.**—The engineer and manager is to bring up a report at the next meeting of the Electric Light and Tramway Committee upon the question of providing additional condensing plant at the generating station. He has already stated that the plant is necessary.

**Faversham.**—Two local firms of electrical contractors have complained of one of the employés of the T.C. "constantly soliciting and executing electric light orders," and protesting against the practice. When the matter came before the T.C. on September 20th, the electrical engineer stated that only one order had been executed by the employé in question, but he had now directed him not to undertake any more outside work.

**Fife.**—The Tayside Electric Light Co. recently applied to Newport T.C. for leave to extend their wires to Bay Road by the usual overhead system adopted in the burgh. The Town Council refused to grant leave unless the underground system were adopted. A petition, signed by over 150 residents, in the course of which it is contended that no exception should be taken to the overhead wire system as established with official approval, is to be presented to the Council.

**Grimsby.**—At a meeting of the Lighting Committee of the T.C. on September 21st, it was suggested that an electrical showroom should be opened for the display of fittings, radiators, lamps and other appliances. The engineer said that such a method had been adopted at Hull with much success. It was an expensive matter, however, and he doubted if the time was at present opportune for such an innovation. No action was taken in the matter.

**Haslingden.**—The L.G.B. has sanctioned a loan of £1,160, repayable in 10 years, for the electric lighting of the workhouse and the new union infirmary. The Rawtenstall Corporation will supply the current.

**Hastings.**—Our correspondent writes:—"A battle royal appears to be raging at Hastings as to the desirability of substituting electric lighting for gas at the Workhouse buildings. The Guardians have decided to ascertain if the Corporation can supply the current at a sum not exceeding that now paid to the gas company, an average of about £280 a year. Only a few years ago when the Workhouse was built, gas carried the day, owing to the cost of installation of electric light, which was then estimated at about 10s. per point. Mr. Botley, the gas company's manager, was called in, and a scheme of lighting which he proposed was adopted. At the last meeting of the Guardians a long letter was received from Mr. Botley, but a majority of the members objected to the communication being read till the sub-committee on electric lighting had reported. Meanwhile a sub-committee of the Corporation Electricity Committee and a sub-committee of the Poor Law authority are in conference. 'Buy at your own shop,' is practically the argument of those Guardians supporting the electric light; the electricity concern belongs to the ratepayers, and more business must be done in order to make both ends meet. To light the Workhouse the Corporation will be required to lay several hundred yards of main, but *en route* they will be able to substitute electricity for gas at the Borough Sanatorium. On both the Town Council and Guardians the gas company possesses strong supporters, and it is uncertain what will be the result."

**India.**—CAWNPORE.—The *Times of India* says that in order to bring electric light and fans within the reach of people who cannot afford to pay outright, the Indian Electric Supply and Traction Co. has been considering a scheme for hiring out fans and lights and wiring.

The Calcutta *Englishman* says that the proposals regarding the Ghat hydro-electric scheme have matured, and the hope expressed by His Excellency, the Governor, in a speech delivered at Sholapur in July last, that the work would be financed and controlled in India, has been realised. It is stated that the project will be inaugurated by an Indian company, expected to be registered in Bombay in August. "The capital is set down at Rs. 1,70,00,000, a million and a quarter sterling, of which nearly three quarters have been subscribed. Of this the Maharaja of Bhavnagar has taken up 20 lakhs, and the Gaekwar of Baroda 10." The scheme "provides for the utililisation of two or three large lakes at Lanauli, and the installation of an electric transmission plant at the bottom of the Ghats. This will be capable of providing Bombay with 3,000 E.H.P., with a reserve of 10,000. It had been previously proposed to launch a much larger scheme, which has now been divided into sections, each of 10,000 H.P. The present proposal is to install three units, one in reserve, but if in future circumstances demand the operation of the larger scheme this can be conceded by the utilisation of the third lake at Lanauli and the installation at the power station of another couple of 10,000-H.P. units. The cost of providing 50,000 H.P. would be about Rs. 1,00,00,000. If further capital is to be raised to complete the larger project it is proposed to give original shareholders the first option in acquiring it. The Tatas are the promoters of this scheme."

The same exchange says that Messrs. J. Stone & Co., Ltd., London, are supplying 26 of their dynamos and 26 switches, for the electric lighting of passenger trains on the South Indian Railway, together with 875 "Tonum" accumulators cells. On December 31st, 1909, on the broad gauge section of the South Indian Railway, 270 passenger coaches were fitted for lighting with gas on Pintsch's system, and two vehicles were fitted for Stone's electric lighting. On the metre gauge section up to December 31st, 1909, only 218 passenger coaches out of 1,138 vehicles had been fitted with electric lighting on Stone's system; but it is believed that since that date a further number of vehicles has been so fitted, and that other systems are also being given a trial.

**Kirkcaldy.**—The Fife Electric Power Co. have intimated their intention of erecting a power line from Lochgelly to Newton of Wemyss, the proposal being to erect six lines of bare copper wire on wooden poles. The Roads Committee recommends the District Committee to grant permission only on the understanding that the electric cables be placed underground so far as they run across or alongside roads.

**Lahore (India).**—Considerable extensions to the electrical plant of the North-Western Railway at Lahore are now in progress. Two additional boilers, each of 4,020 sq. ft. heating surface, with integral superheaters and chain grate stokers, are under supply by Messrs. Babcock & Wilcox, together with a quantity of pipe work and other boiler house accessories, including a centrifugal feed pump by Messrs. Worthington Pump Co. The two additional generating sets are each of 400 KW. output. The engines are triple expansion, by Messrs. Belliss & Morcom. Further plant will be obtained in the course of next year, consisting of two more boilers and generating sets precisely similar to the foregoing, also an elevated barometric jet condensing plant, having a capacity of 45,000 lb. of exhaust steam per hour, a cooling tower of the forced draught type, and an economiser. The power house, when thus completed, will have a capacity of 2,300 KW. A large number of motors, aggregating some 4,000 B.H.P., are, or will be shortly, under supply for the completion of the electrification of the railway workshops, &c. The railway staff quarters, some 300 houses in all, are shortly to be provided with fans and electric lighting. A proposal is also on foot that the railway power house should give a bulk supply for the service of the Lahore civil station.

**London.**—POPLAR.—The annual accounts of the electricity undertaking for the year ended March 31st last show that the net income from sale of energy amounted to £42,251, showing an increase on the previous year of £4,441. The working expenses amounted to £21,835, this being an increase on the previous year of £2,368, while the gross profit was £20,415, as against £18,342; the net profit was £4,425 as against £3,381. The total available surplus was £6,293, and it was proposed to pay various sums out of this of a capital nature which will reduce the unappropriated balance to carry forward £5,336. The increase in units sold over the previous year was 2,035,116, and the net cost of coal £924 more, the extra units thus being produced at a fuel cost of 0·109d. The cost per unit sold was reduced by ·0663d., equivalent to a reduction of £2,068 on the full output. The Committee states that the percentage of gross profit obtained to outstanding capital at the close of the year was 8¼ per cent., an increase of 1 per cent. over the previous year. The average depreciation set aside by the metropolitan companies is slightly over 1½ per cent., so that the comparable result with company dividends is nearly 7 per cent. Loans were redeemed during the year to the amount of £7,020, and £956 was paid out of revenue for work of a capital nature, making £7,982 in all, or 3¼ per cent. of the total capital value of the undertaking at the close of the year. The proportions of increase in actual output are as follows, viz., private lighting (including domestic supply), 3 per cent.; power, 24½ per cent., while public lighting has not varied. Since the introduction of a modified tariff to meet the requirements of long-hour lighting consumers, a considerable number of consumers of this class have been connected. Negotiations are in progress with regard to bulk supply. It is now possible to fully compare the actual result of the change-over from carbon to metallic-filament lamps in street lighting. In the year prior to changing over, the cost for energy supplied was £1,625, and last year it was £1,170, a saving of £454. The cost of lamp renewals was in the first instance £162, and in the second instance £320, an increase of £158, thus showing a net saving to the borough of £296, without taking into consideration the number of lamps converted from gas in the interval. By the change the borough has gained in efficiency of street lighting from an initial 24 C.P. per post, and a steady diminution during use, to 50 and 100 C.P. per post without any material reduction during the life of the lamps. The provision for depreciation, continues the report, viz., 3¼ per cent., is not unduly low, and the proposals for augmentation agreed with the L.C.C. will considerably increase this percentage in the future. The net result, after providing for depreciation, is 5 per cent. profit on the capital value of the undertaking.

BATTERSEA.—In order to strengthen the mains in the neighbourhood of the Town Hall so as to maintain the pressure of supply and cope with increasing demand, a ·5 concentric feeder cable is to be laid at an estimated cost of £720.

HACKNEY.—On Thursday last week the Borough Council Electricity Department opened a showroom in Mare Street, where demonstrations were given of electric lighting with well-known metallic-filament lamps, electric cooking, electric heating, ventilating fans, motor driving, and, indeed, all sorts of things to appeal to the trade and residential ratepayers of the borough. The premises are small, but with their brilliant illumination and variety of contents they should prove both a good advertisement and an educative influence bringing grist to the departmental mill and satisfaction to Mr. Robinson, the borough electrical engineer. We hardly know whether to attribute it to the curiosity of the juvenile mind concerning everything electrical that was visible through the window, or whether it was owing to the cookshop smell of the preparation of the luxurious (!) feast which was being cooked in the Archer (G.E.C.) cooking range, but all the nippers of 'Ackney were agog with eyes alert, mouths awatering and noses as near to the window pane as circumstances would permit. The department is going to conduct the sale of fittings, motors and accessories, and a roaring municipal trading in radiators was in progress at the time of our visit. The department also carries out and maintains complete electrical installations for all purposes, arranges cash or hire-purchase terms, and so on, in easy ways which may be found to meet the needs of a large portion of the prospective consumers of the borough.

**Morecambe.**—The Corporation has decided to purchase a motor pump for boiler feed.

**Nantwich.**—The Brine Baths Hotel is to be lit by electricity. Current will be supplied from the Brine Baths Farm.

**Newcastle-on-Tyne.**—An important extension has recently been made to the transforming plant at the Carville Works, Wallsend-on-Tyne, of the Newcastle Electric Supply Co., in order to meet the increased demand of the collieries in the Blyth (Northumberland) district, and also in the County of Durham. The existing sub-station has been duplicated, a new building having been erected by Messrs. J. and W. Lawry, of Newcastle. The building has two floors, in the lower of which are contained four 4,000-H.P. transformers, in oil, while on the upper floor is the switchgear for operating them. The transformers receive the current generated by the turbo-alternators in the adjoining engine room at a pressure of 5,750 volts, and transform it to 20,000 volts, at which pressure the current leaves the sub-station. To reduce the heat of the oil, a special arrangement of water-cooling pipes has been installed, which has added over 2,000 H.P. to their capacity. The total capacity of the sub-station at Carville is now about 16,000 H.P.

**Perth.**—Mr. Lambert, the electrical engineer, recently reported to the Corporation Electricity Committee regarding the introduction of mechanical stoking plant. He was instructed to communicate with other towns, and with manufacturers, and get full particulars.

**Plymouth.**—The electrical engineer (Mr. E. G. Okell) has just issued his annual report upon the electricity undertaking and street lighting for the year ending March 31st, 1910. The year had been marked by a substantial increase in the number of lamps connected, in the number of consumers of electricity, and in the output for general supply purposes, new business having fully compensated for the diminished consumption occasioned by the increased use of high-efficiency lamps. Connections for supplies to 137 new consumers had been made, and the total lamp connection had increased from the equivalent of 80,817 to 89,107 30-watt lamps. The number of motors increased from 118 to 162, the increase in H.P. being 154¼. The units sold increased from 2,280,707 to 2,456,070. The gross balance of £11,847 represented 7·42 per cent. on the capital expenditure at the end of the year, this percentage being adversely affected by the altered rating to the extent of ·65 per cent. After setting aside £9,692 for interest and sinking-fund charges, there remained £2,155, of which £774 was transferred to rates, and the remainder, £1,381, to the reserve fund. The total amount standing in the reserve fund at March 31st, 1910, was £11,551. An amount of £2,500 was, however, required to meet liabilities in connection with the turbine now being installed.

The Electricity Committee of the T.C. has permitted Mr. E. M. Jewson, whose saw mills were destroyed by fire last week, to obtain a supply of power from Devonport Corporation for three months, pending the rebuilding of his works, on condition that if a constant supply of power is subsequently required it must be obtained from the Plymouth Corporation's works.

(*Continued on page* 543.)

# ELECTRIC HAULAGE IN COLLIERIES AND MINES.

The conveying of coal or ore from the working face, where it is won, to the shaft bottom, whence it is raised to the surface, is an important operation in a modern mine, and one which requires an increasing amount of power as time goes on, and the workings extend. While it may be possible in a few cases to use electric locomotives, the work is almost invariably carried out by rope haulage gears, formerly driven by steam or compressed air, but now in the more modern installations by electric motors.

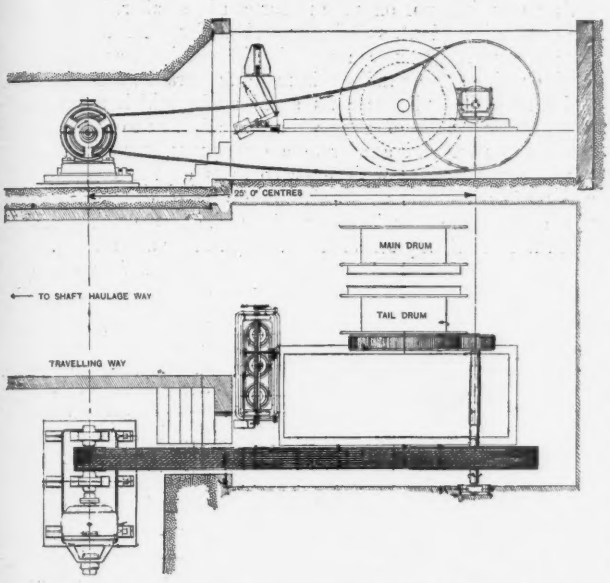


Fig. 1.—Steam Haulage Gear Converted to Rope Drive.

The coal at the working face is first filled into tubs, which are taken to the main haulage road, either by hand, ponies, or, where the gradients are too steep for this method, or the quantity of coal to be handled too great, by auxiliary haulage gears. When a sufficient number of tubs have been collected, these are formed into a train, which is hauled to the shaft bottom, where the system is on the main rope or main and tail method. If the main haulage works on the endless system the tubs are hitched on to the endless rope as they arrive.

## Types of Main Haulages.

*Endless Rope.*—If the main roads are wide enough to admit of two sets of rails, by far the most economical method of hauling which can be adopted is the endless rope system. In this case the haulage gear drives an endless rope (at a speed of from 1½ to 2 miles per hour), which extends from the shaft bottom along one set of rails to the end of the main road, where it passes round a pulley with automatic tightening gear, and back again along the other set of rails. The full tubs are attached to the one rope, and travel up one set of rails; the empties are hauled by the other rope along the other set of rails. The tubs are hitched to the rope at approximately equal distances apart, say 20 yards or so, and on a gradient the weight of the empty tubs coming down partially balances the weight of the full tubs going up, which arrangement, of course, economises power. A further advantage of this method is that the load on the driving engine is practically a constant one, so that much less power demand is required than where the main and tail or main rope systems are used.

*Main Rope.*—It very often happens, however, that it is inconvenient to make the roads wide enough for the two sets of rails, and in this case some other method must be adopted. Where the gradient along the whole of the run is sufficient to cause the empty tubs to run back, and at the same time draw the rope after them, the main or single-drum type of haulage is used, and it is generally found that a gradient of 2 in. to the yard or over will enable the tubs to self-act as described. The tubs are collected until there are sufficient to form a train; these are drawn up to the shaft bottom by the main rope, and then an empty train of tubs is attached to the same rope, and allowed to run back by gravity, drawing out the rope again as it goes.

*Main and Tail.*—Very frequently, however, the gradient may be less than 2 in. to the yard, or may vary along the road, so that the tubs will not run back the whole way by gravitation. In this case a lighter rope called the tail rope, driven from a separate drum on the haulage, is carried to the end of the main road and round a fixed pulley there, and is fastened at the rear of the train. As the full tubs are hauled up by the main rope they draw out the tail rope behind them (the drum on which this tail rope is coiled being allowed to revolve as this occurs), and when the train reaches the shaft bottom the tail rope is hitched on to the front of the empty train and draws it back, the main rope being attached to the rear of this train and pulled back with it, so as to be ready for the next set.

The speed of working may vary from 3 to 12, or even 15 miles per hour, according to the condition of the rails, the rolling-stock and the gradients. The gears may have to work on gradients of from level to possibly 50° in a shale mine, the latter conditions being almost equivalent to vertical winding.

In both the main rope and main-and-tail systems, the demand for power varies very considerably, and the method is always less economical than the endless one. There is another system which is sometimes adopted on steep gradients, and that is the double-drum main rope gear, with one set of empty tubs going down and partially balancing the set of full tubs which is being hauled up. Where this system is adopted, either two sets of rails are necessary, or a by-pass arrangement on the line at a suitable distance down to enable the sets to pass each other.

*Method of Driving Haulages.*—Originally all the main hauling engines were driven either by steam or often by compressed air, and auxiliary inbye haulages were worked either by compressed air, or from the rope of the main haulage by passing this rope round a pulley and making it drive the same. For driving main haulages, the engines are sometimes placed at the shaft bottom, in which case steam pipes have to be taken down the shaft, and sometimes on the surface, the ropes passing down the shaft over suitable pulleys and guides.

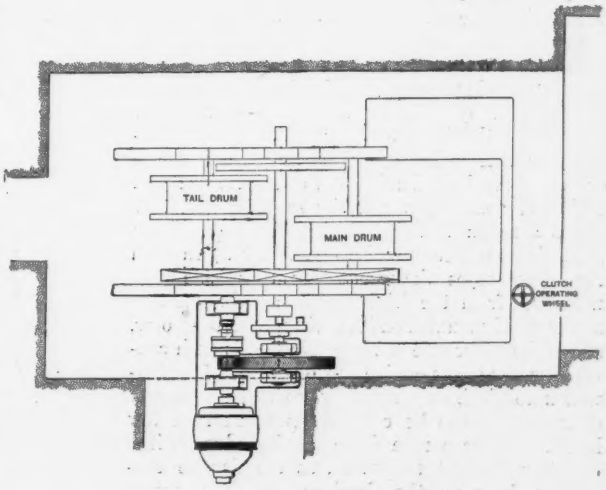


Fig. 2.—Steam Haulage Gear Converted to Gear Drive.

It is obvious that electricity has a number of advantages over the above methods, for if a steam haulage is placed at

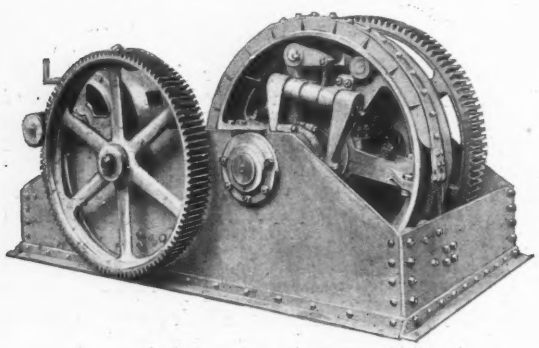

Fig. 3.—Portable Endless-Rope Gear with Friction Clutch.

the shaft bottom there is considerable loss in radiation in the steam pipes, and these also make the shaft unpleasantly warm and require a good deal of attention. An electric cable is, of course, much easier to install and to keep up and more satisfactory in every way. In addition to this, owing to the losses in the steam pipe, the electric haulage is more efficient and economical. If a steam haulage is placed at bank close to the boilers, its efficiency will probably be as high as the efficiency of an electric haulage, as, of course, the latter has both the losses in its own motor and in the generating plant, but at the same time the moving ropes in the shaft, necessary for the steam haulage, are of considerable disadvantage, so that here again the electric drive is preferable.

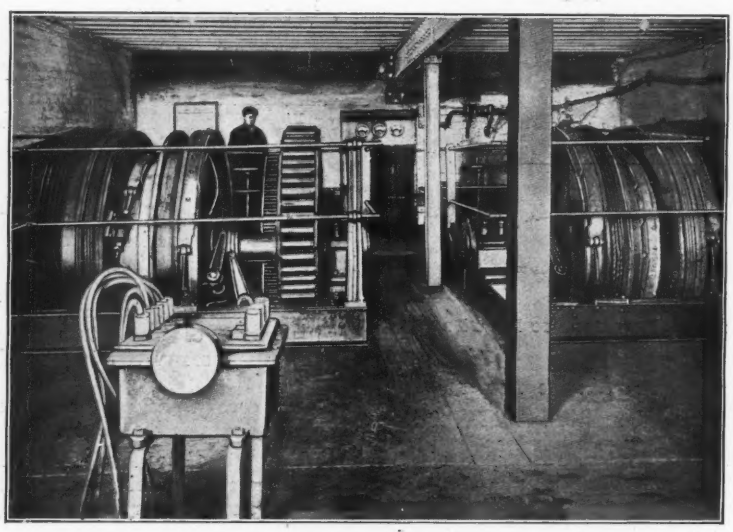

Fig. 4.—Rope-Driven Double-Road Endless-Rope Haulage Gears.

*Conversion of Existing Hauldges.*—Very often, to reduce the cost of the installation or for purposes of convenience, it is desirable to convert existing steam or compressed-air haulages to electric driving. This can generally very easily be done, and fig. 1 shows a steam haulage converted to rope drive; fig. 2 shows one converted to gear drive. In both the above cases the connecting rods have been uncoupled from the driving shaft, and in one case a spur wheel mounted on it is driven from the motor, and in the other case a rope pulley. In such conversions the steam engine can often be left otherwise untouched, as a stand-by, so that in case of emergency it can be coupled up again in a few hours. Where a rope drive can be adopted, it is certainly the best to put in, as the flexible connection between the haulage and the motor relieves the latter of shock, and considerably prolongs the life of the bearings, working parts, &c. In addition to this the rope transmission is very much easier and generally cheaper, both in first cost and maintenance.

*Three-Phase versus Continuous Current.*—Generally the power equipment of a mine will already be in existence before the installation of the haulage; in any case, other factors will affect the decision as to whether three-phase or continuous-current plant is installed. Where, however, a new installation is being put down, it is desirable to bear the following points in mind:—

A three-phase motor has the single advantage that it is inherently of stronger mechanical construction than a continuous-current motor, but it has a number of disadvantages. In the first place, its speed is practically constant, and the speed cannot be economically varied, so that where the trains have to be drawn over a road with varying gradients, the power demanded will vary very considerably, and possibly on the steepest gradient may be very great. With continuous-current machinery the motor can be heavily compounded or series wound, so that it automatically slows up on the heavy gradients, and takes considerably less power (owing to the speed of the set dropping) than a three-phase machine. This means that not only the motor can be smaller, but also the generating plant, switchgear and cables. At the same time, the same output can probably be obtained, as on the level, or where the gradient is more favourable, the motor will automatically increase its speed again, which a three-phase motor cannot, of course, do. In addition to this, it is possible to start and accelerate a continuous-current motor much more smoothly, with fewer contacts on the controller and smaller resistances. At the same time, of course, three-phase motors are very largely used, as the above points are often not sufficiently serious to outweigh other advantages.

*Starting Conditions.*—When a train of tubs is got under way it is first necessary to pull in the slack of the rope slowly until this is taut. The tension on the rope must then be increased so as to get the tubs gradually under way, one after the other, without unnecessary jerking, and when the whole set is moving the slack of the tail rope has next to be taken up until this also is just tight. The set is then to be accelerated up to full speed without jerking, a slight tension being kept on the tail rope, particularly in going down hill, so that the sets do not overrun the main rope and foul it.

From the above it is clear that the controller for starting

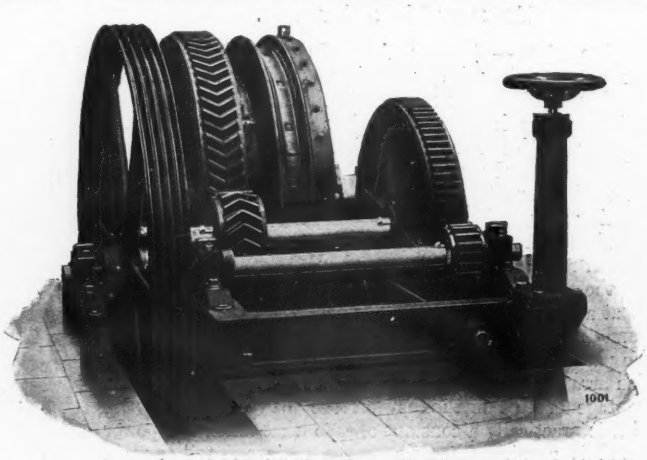

Fig. 5.—Single-Drum Endless-Rope Haulage Gear for Rope Drive.

a haulage-motor must be very liberally rated, and capable of keeping the motor running at a slow speed some little time while the set is being got under way. It is also necessary that the controller should be capable of starting slowly

against a moderately light load, or against full load, as, of course, it might be necessary to start the set (in case it had been stopped for any reason), either down hill or on an up gradient.

The question of the controller for three-phase motors is one which requires special attention to fulfil the above conditions.

*Starting on Friction Clutches.*—Where the power is not excessive or the speed of rope not more than, say, five or six miles per hour, a properly designed friction clutch is often handier than a controller, and has several advantages. The motor can be started light and run up to full speed and then the load taken up by gradually putting on the clutch, and it is thus applied at a time when the motor is under the best conditions for developing heavy torque with minimum current demand, particularly in the case of a three-phase motor. It is necessary that the clutch should be of a type which is easily controlled and can allow of slipping, and a type very generally adopted consists of a clutch strap attached to the haulage drum itself, the strap being lined with wood blocks which grip like a brake on a clutch track, which is keyed to the driving shaft. The drum is bushed with gun-metal, so as to run loose on the shaft, and is provided with a suitable arrangement of levers and sliding collar for gradually tightening the clutch strap, so that this slowly tightens on the revolving track and starts up the drum. Generally a screw and hand wheel is provided at the driver's platform for doing this. This clutch is very simple in operation, there is practically nothing to go wrong with it, and the only wear takes place on the wood blocks, which can be easily and cheaply renewed. Fig. 3 shows such a clutch fitted to a portable endless gear. The Hele-Shaw clutch is also a good deal used for small gears and gives good results.

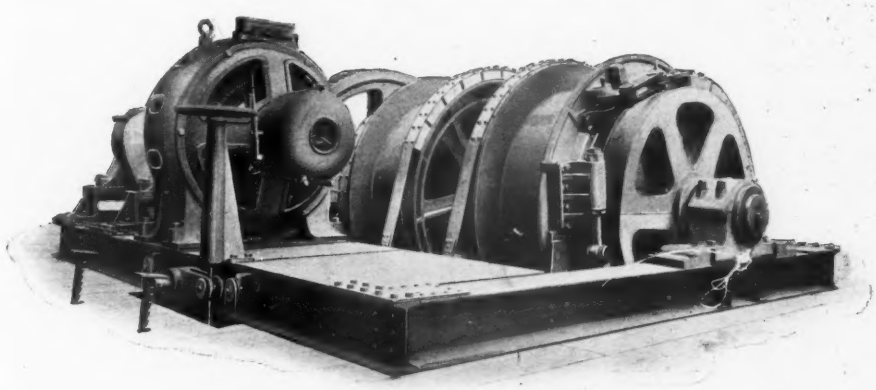

Fig. 6.—Main and Tail Haulage Gear, Direct Driven.

*General Types of Electric Haulages.*—A few examples of various haulages may be of interest, and illustrations are here given of gears for both direct and rope drive. In the case of the direct-driven haulages, the motor is generally mounted on the haulage bed; in the case of large gears the motor shaft should always have a flexible coupling and drive a short countershaft running in two separate bearings and carrying the pinion. This arrangement, to a certain extent, relieves the motor of shock, and what is more important, reduces the wear on the motor bearings. With three-phase machinery where the air-gap is small it is much better to have the motor bearings quite independent of the gearing bearings, which thus take the greater part of the wear. Where motors running at high speeds are employed, or a big ratio of reduction is required, helical machine-cut gearing is being considerably used, as this gives high efficiency and silent running. It is, of course, considerably more expensive, and where the additional noise is not objected to, straight machine-cut teeth work very well, the motor pinion being of forged steel, and the pinion into which it gears cast-iron, both with machine-cut teeth. The main gearing on the drum-shaft, which runs at a slow speed, is generally machine moulded. For smaller portable gears a raw-hide pinion can be employed as long as it can be kept moderately dry, but if it has to work in a very damp position the raw hide is liable to swell and give trouble. Where it is practicable, a rope drive makes by far the sweetest means of transmitting the power, and as one set of gearing is done away with, the cost of the rope drive is just about the same as, or, if anything, a little cheaper than, the gear drive.

Fig. 4 gives a very good idea of a modern underground haulage room, and shows two double-road endless-rope haulage gears. Each of these gears is driven by cotton ropes from a motor placed in front and on one side so as to be clear of the haulage ropes, the motors being of the ordinary three-phase slip-ring type. These motors are normally started light with the friction clutches thrown out, and are left running constantly. Any starting or stopping of the haulage rope which is required is carried out by means of these clutches, which are of the type already described. The driver stands at the back of the gear, where the hand-wheel for operating the clutches and also the brake levers are placed.

Fig. 5 shows a single-drum endless-rope haulage gear arranged for rope drive with friction clutch. These endless gears can be made with any number of drums for working separate roads, sometimes as many as five drums being driven by a single motor.

Fig. 6 shows a main and tail haulage gear driven direct by means of a three-phase motor, the motor being normally rated at 150 H.P., and capable of working up to 300 H.P. before falling out of step. The machine is of the slip-ring type, with slip-rings outside the casing contained in a cast-iron protecting case. The haulage drums are about 6 ft. diameter on the trod. Each drum is provided with a powerful band brake controlled by foot lever carried to the back of the haulage, and placed conveniently for the driver, and is also provided with a friction clutch of the type already described, with screw and hand wheel for throwing the drums in and out of gear. A single hand wheel is provided for operating the two clutches, so arranged that when one drum is thrown in gear the other is free to revolve as required, and also

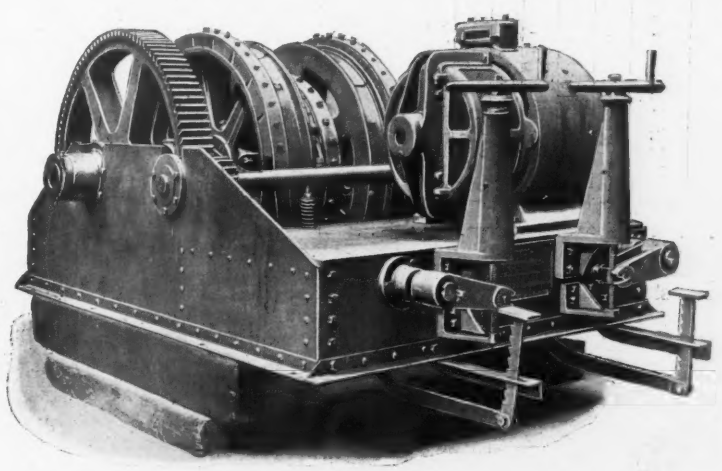

Fig. 7.—Portable Double-Road Endless Haulage Gear.

provided with a central position in which both drums are out of gear.

Fig. 7 shows a portable double-road endless haulage of 30 H.P., a single motor driving the two drums through standard friction clutches. Separate hand wheels are provided for working these clutches, at the back of the gear, where also are the foot levers for the brakes. The whole gear is built up on a steel-plate framing stiffened with angle-bars, and designed so as to be rigid and at the same light. All parts are bolted together, so that the whole can be taken apart at bank and easily re-erected underground.

*Auxiliary Haulages.*—In these days small auxiliary haulages of from 5 to 20 H.P. are rapidly taking the place of ponies, and a few illustrations may be of interest.

Fig. 8 shows a portable tandem main and tail haulage mounted on trolley wheels. The haulage is driven direct by a 20-H.P. motor of either the three-phase or continuous-current type. The first motion reduction consists of a Hans Renold silent chain, and the second of main spur gearing. The motor is mounted on the haulage, and a foot-plate is provided at the back for the driver, on which the controller and switch for operating the motor, together with the brake levers and lever for throwing either drum into gear, are placed. This haulage is also built up of steel plates, so as to be strong and light.

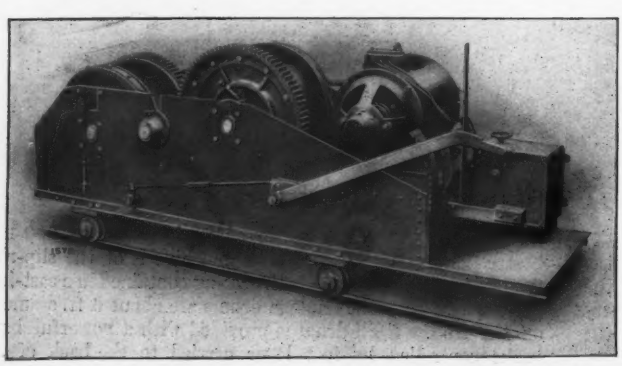

Fig. 8.—Portable Tandem Main and Tail Haulage Gear.

Fig. 9 shows a similar type of gear, but arranged with single drum for use on gradients where the tubs will self-act, and endless gears can also be obtained on the same lines.

The above illustrations represent some of the standard plant manufactured by Messrs. Ernest Scott & Mountain, Ltd., and the illustrations have been supplied by them.

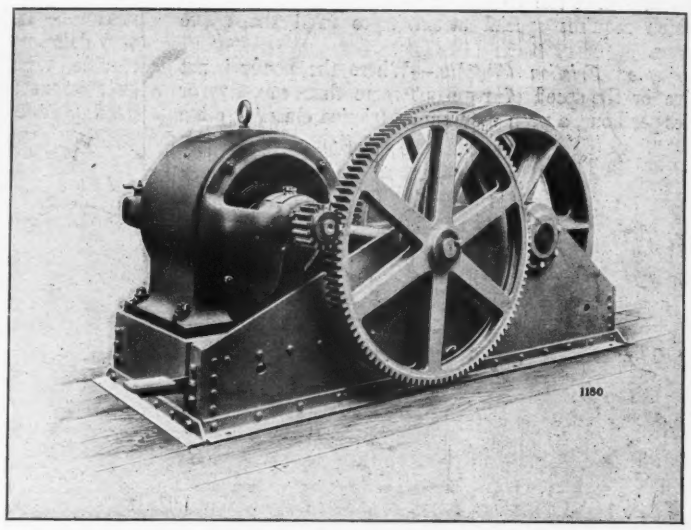

Fig. 9.—Single-Drum Portable Haulage Gear.

*Calculations of Power.*—The calculations of power for all classes of haulage are all comparatively simple, but conditions vary so much that general rules of course cannot be given. It is first necessary to have particulars of the length of the road, with maximum and minimum gradients in each direction (preferably a contour of the road should be obtained), the quantity of coal which it is required to haul along this road in a given time, say eight hours, and the maximum speed at which the set can be run, depending on the condition of the road and the way the rails are laid. The capacity of the tubs and the weight of the tubs are then also required, and from this can be calculated the number of tubs which have to be drawn along the road in a given time. As the maximum permissible speed is also known, the time required for a complete journey from the face to the shaft and back again can be calculated, due allowance being made for the time required for changing the sets. The number of the tubs required in a train or set can then be obtained from the above figures. It is next necessary to find the power which will be required at the maximum gradients in either direction, and where main rope or main and tail haulage is installed, this power is equal to the power required to haul the total weight of the train up the gradient plus the power

TABLE I.—H.P. Required for Main and Tail Haulage at 10 Miles per Hour.

| Actual incline in inches per yd. | Virtual incline in inches per yd. | Load in tons. 5 | 7·5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| —2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| —1 | 1 | 8·3 | 12·5 | 16·6 | 25 | 33·2 | 41·4 | 50 | 58 | 66·4 | 76 | 80·8 |
| 0 | 2 | 16·7 | 25 | 33·3 | 50 | 66·6 | 83 | 100 | 116 | 133 | 150 | 166 |
| 1 | 3 | 25 | 37·7 | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 225 | 250 |
| 2 | 4 | 33·4 | 50 | 67·5 | 100 | 134 | 167 | 200 | 233 | 270 | 300 | 334 |
| 3 | 5 | 41·5 | 62 | 83·5 | 125 | 167 | 208 | 250 | 290 | 334 | 375 | 416 |
| 4 | 6 | 50 | 75 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 |
| 5 | 7 | 58·3 | 87 | 117 | 175 | 234 | 294 | 350 | 408 | 468 | 525 | 588 |
| 6 | 8 | 66·3 | 100 | 133 | 200 | 267 | 333 | 400 | 465 | 532 | 600 | 666 |
| 7 | 9 | 75 | 112 | 150 | 225 | 300 | 375 | 450 | 520 | 600 | 675 | 750 |
| 8 | 10 | 83·5 | 124 | 166 | 250 | 333 | 420 | 500 | 580 | 664 | 750 | 830 |
| 9 | 11 | 91 | 137 | 183 | 275 | 366 | 459 | 550 | 640 | 732 | 825 | 918 |
| 10 | 12 | 99 | 150 | 200 | 300 | 400 | 500 | 600 | 696 | 800 | 900 | 1000 |
| 11 | 13 | 108 | 162 | 217 | 325 | 433 | 542 | 650 | 755 | 868 | 975 | 1080 |
| 12 | 14 | 116 | 174 | 233 | 350 | 466 | 584 | 700 | 815 | 932 | 1050 | 1168 |

TABLE II.—H.P. Required for Endless-Rope Haulage on Road 1,000 Yards Long.

| Actual incline in inches per yd. | Virtual incline in inches per yd. | Output in lb. per minute. 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 | 1250 | 1500 | 1750 | 2000 | 2250 | 2500 | 2750 | 3000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| —2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| —1 | 1 | ·5 | ·75 | 1 | 1·2 | 1·5 | 1·7 | 2 | 2·3 | 2·5 | 3·1 | 3·7 | 4·4 | 5 | 5·6 | 6·2 | 6·9 | 7·5 |
| 0 | 2 | 1 | 1·5 | 2 | 2·5 | 3 | 3·5 | 4 | 4·6 | 5 | 6·3 | 7·6 | 8·9 | 10 | 11·4 | 12·7 | 14 | 15 |
| 1 | 3 | 1·5 | 2·3 | 3 | 3·8 | 4·6 | 5·3 | 6 | 6·8 | 7·6 | 9·5 | 11·4 | 13·3 | 15·2 | 17 | 19 | 21 | 23 |
| 2 | 4 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12·6 | 15 | 17·6 | 20 | 23 | 26 | 28 | 30 |
| 3 | 5 | 2·5 | 3·8 | 5 | 6·3 | 7·6 | 8·9 | 10 | 11·4 | 12·7 | 15·8 | 19 | 22·3 | 25·4 | 28 | 32 | 35 | 38 |
| 4 | 6 | 3 | 4·5 | 6 | 7·6 | 9 | 10·6 | 12 | 13·7 | 15·2 | 19 | 22·8 | 26·6 | 30·4 | 34 | 38 | 42 | 45 |
| 5 | 7 | 3·5 | 5·3 | 7 | 8·8 | 10·5 | 12·4 | 14 | 16 | 17·7 | 22 | 26·5 | 31 | 35 | 40 | 44 | 49 | 53 |
| 6 | 8 | 4 | 6 | 8 | 10 | 12 | 14·2 | 16 | 18·2 | 20·4 | 25·3 | 30·4 | 35 | 41 | 45 | 51 | 55 | 60 |
| 7 | 9 | 4·5 | 6·8 | 9 | 11·4 | 13·7 | 16 | 18 | 20·5 | 22·8 | 28·5 | 34 | 40 | 45 | 51 | 57 | 63 | 68 |
| 8 | 10 | 5 | 7·6 | 10 | 12·6 | 15·2 | 17·7 | 20 | 22·5 | 25·3 | 31·7 | 38 | 44 | 51 | 57 | 63 | 69 | 76 |
| 9 | 11 | 5·5 | 8·3 | 11 | 14 | 16·7 | 19·5 | 22 | 25 | 27·8 | 34·7 | 41·7 | 49 | 55 | 62 | 69 | 76 | 83 |
| 10 | 12 | 6 | 9 | 12 | 15·2 | 18·2 | 21·3 | 24 | 27·3 | 30 | 38 | 45 | 53 | 61 | 68 | 76 | 83 | 90 |
| 11 | 13 | 6·5 | 9·8 | 13 | 16·4 | 19·8 | 23 | 26 | 29·6 | 33 | 41 | 49 | 57 | 66 | 74 | 82 | 90 | 98 |
| 12 | 14 | 7 | 10·6 | 14 | 17·7 | 21·3 | 24·8 | 28 | 31·8 | 35·4 | 44 | 53 | 62 | 71 | 80 | 88 | 97 | 106 |

required to overcome the friction of the train and the friction of the main and tail rope. The power required to raise the total weight of the train can be easily calculated, but the power required to overcome the friction of the rope and the friction of the train is a very variable quantity, and depends almost entirely on local conditions, such as the number and condition of the pulleys for supporting the rope, condition of the rails and rolling stock, &c.

It has been already mentioned that with a gradient of 2 in. to the yard it is generally found that any set of tubs will self-act down the incline, drawing the rope after it, and hence it follows that if an allowance of 2 in. to the yard is added to the actual gradient against which the load has to be hauled, this will generally cover all that is required to overcome the friction of the sets and rope. Assuming, therefore, that a train had to be hauled up a gradient of 4 in. to the yard, in order to make allowance for friction, &c., it would be assumed that the gradient was 6 in. to the yard, and calculations based on this would cover friction. Of course, on very long roads, an additional allowance would have to be made. It is a very safe rule, however, in calculating power for mining work, always to make a liberal allowance everywhere, and to put in liberally rated plant, as when once this is installed it frequently receives very different treatment to what was originally intended.

*Endless Rope Calculations.*—In the case of endless rope haulage, as already described, the empty tubs coming back practically balance the weight of the full tubs going forward. The weight of coal delivered in a given time multiplied by the distance through which it is being raised represents the actual work done, and to this, of course, must be added an allowance for friction, both on the full and empty tubs, and on the rope. On an average length of road, this can again be taken as about 2 in. or 3 in. to the yard, and the power can be calculated in a fairly simple manner.

For rough calculations the two tables given herewith explain the system. These tables have been prepared by Messrs. Ernest Scott & Mountain, Ltd., and are given in their recent mining publications.

## POWER FOR FOUNDRY EQUIPMENT.

[COMMUNICATED.]

It is well known that in fitting motor drives to machine tools there is a tendency to install motors of too large size. This arises from the fact that the power requirements of the machine are seldom known with any degree of accuracy, and the power necessary is often approximated, and a liberal allowance added in order to be on the safe side. This results in considerable loss in efficiency, because the ordinary motor is most efficient at, or near, its designed full load. It often occurs also, that the power required to drive a machine changes with the character of the work done and the methods employed, so that a motor which was at one time of the proper size may very easily, under different conditions, be either too large or too small. Determination of the power actually required or delivered by the motor by simple voltmeter or ammeter readings is a comparatively easy matter, and, where the electric drive is used, motors can be changed without much trouble. Tests often show that such changes would promote efficiency, as the following changes, made as a result of tests of electrically-driven tools in a large foundry, amply prove.

In this foundry a 40-H.P. six-pole motor, rated at 975 R.P.M. light and 840 revolutions loaded, used for driving a Roots blower, one hour after starting took 26 KW. A 35-H.P. motor running at 900 revolutions was eventually substituted for this motor, and a corresponding gain in efficiency was the result. For driving a sand mixer a 5-H.P. motor running at 1,200 R.P.M. was employed; this motor took 0·92 KW. lightly loaded and 1·84 KW. when fully loaded. It has since been replaced by a 4-H.P. alternating-current motor, running at 1,200 revolutions. A 7-H.P. motor, running at 950 revolutions, driving a suction fan, consumed 2·86 KW. when working at normal load; this motor has now been replaced by a smaller one running at a greater speed—viz., 5 H.P., 1,800 revolutions. A line shaft was originally driven by one 30-H.P. motor, running at 650 revolutions, and taking 2·2 KW. light and 3·5 KW. fully loaded. This has just been taken out, and in its place a 7½-H.P. motor has been installed, the speed of which is 1,200 R.P.M.

These changes were found to work so satisfactorily that it was decided to replace all the motors driving the remainder of the foundry-house plant. Accordingly, a 2½-H.P. motor having a rated speed of 1,620 R.P.M., used for driving a double grinder, which, with the grinder idle, consumed 0·68 KW., and with two men grinding light castings, consumed from 1·1 to 1·8 KW., was replaced by a 2-H.P. motor, rated at 1,800 R.P.M. Two instances occurred in which it was found desirable to increase the size of the motors. The first of these was in the driving of a 36-in. exhaust fan employed in the removal of gases from the core room and ovens; here, a 2-H.P. motor, running at 1,280 R.P.M., and consuming, under normal load, 1·8 KW., was replaced by a 3-H.P. motor running at 1,800 R.P.M. In the second instance, a 2½-H.P. motor, rated at 1,800 R.P.M., driving a 36-in. band saw, a 14-in. bench saw, and a 7-in. lathe, showed the following conditions: Driving the shaft, light, the motor consumed 0·66 KW.; driving a band-saw on 2-in. pinewood, the consumption was 1·1 KW.; driving a band-saw, with 2-in. plank on bench saw, the consumption was 3·3 KW. This load was so excessive that the motor speed was reduced to 70 per cent. of normal. The motor was eventually replaced by a 5-H.P. motor, running at 1,800 R.P.M.

It remains to be added that the original motors were all of the direct-current type designed to operate on a 500-volt circuit; the new motors were all of the three-phase alternating-current type, wound for 550 volts.

## LIGHTING and POWER NOTES.

(*Continued from page* 538.)

**Radcliffe.**—The U.D.C. has decided to extend moral support to the Bill of the I.M.E.A., seeking powers to enable local authorities to supply fittings, &c., and to wire consumers' premises, by requesting the local Member of Parliament to support the measure. The Council hold the powers sought for by their local Act.

**Ramsgate.**—The E.L. Co. has made generous concessions to tradesmen for illuminating their premises during the shopping week which commences next week, and has offered prizes for the best illuminated shops.

**St. Just (Cornwall).**—There is every probability of St. Just being supplied with current for lighting, owing to the Urban Electric Supply Co. bringing a cable to Botallack.

**Southend.**—The T.C. has decided to apply to the B. of T. under Sec. 6 of the E.L. Act, 1909, for authority to supply current to a cinematograph hall at Leigh-on-Sea, owned by Mr. J. Mitchell. The Leigh U.D.C. has consented to the application.

**Stirling.**—The Council has granted permission to the Scottish Central Electric Power Co. to cross eight roads from Denny to Stirling with high-tension overhead wires.

**Wakefield.**—We are informed that our note on page 460, so far as it refers to meter rents, is not quite correct; the charge for meters is only being put on in order to increase the revenue from those consumers whose demands are inadequate to meet the cost of service charges. When the quarterly account for electricity supplied amounts to 2s., the meter charge will not be enforced.

**West Ham.**—Application was made during the vacation to the L.G.B. for a loan of £7,946 for motors, and £6,027 for a turbo-alternator, and sanction has been received from the Board to the raising of these amounts. The Electricity Committee reports that in connection with the accounts of the undertaking to March, 1910, it has decided to write down the value of certain stores by £2,800, and has agreed to the appropriation of part of the reserve fund to meet the deficiency. The Committee further reports that on a communication from the borough treasurer, it has resolved to ask the Finance Committee to include a sum of £18,000 in the next half-year's estimates, being the estimated deficiency on the electricity undertaking at March 31st, 1911. Mr. Couzens, the electrical engineer, reported that with regard to the contract for the new turbo-alternator, placed with the British Westinghouse Co., the contractors agreed to replace the existing 3,000-KW. turbine with one of the Rateau type, the guarantees being the same as for the new set provisionally ordered, which latter

are materially better than those in the original contract. The contractors state that these figures were given in good faith, but they were not prepared to guarantee them under penalty; they are, however, prepared to make guarantees substantially better than those covered by the original specification. With regard to the delivery of the new turbo-alternator, the order for which has been provisionally placed, after investigation, Mr. Couzens was not satisfied that the contractors could adhere to the original delivery given for December of this year. As, due to different causes, some of the new supply contracts will not commence until after the winter's load, as far as can be seen the machine will not be required until next year, say, in July. He, therefore, recommended that this course be adopted, and the existing turbine replaced with the Rateau machine as soon as possible. This the Committee agreed to.

**Wigan.**—The T.C. has received from the L.G.B. sanction to a loan of £30,083 for E.L. purposes.

**Wolverhampton.**—A L.G.B. inquiry was held on Friday into the application of the T.C. for a loan of £6,740 for extensions to the refuse destructor and power plant at the Crown Street depôt. It was explained that by the additions a greater amount of steam would be supplied to the electricity department during the hours when it was most needed. There was no opposition.

## TRAMWAY and RAILWAY NOTES.

**Belfast.**—The Tramways and Electrical Committee on 19th inst. considered a scheme submitted by the sub-committee in connection with the proposed tramway extensions in various parts of the city. After considerable discussion, it was decided, in connection with the proposed new line from Antrim Road to Old Cavehill Bridge, to omit from the sub-committee's report the recommendation to purchase the interests of the owners of the old Cavehill railway, which lies to the north of the proposed extension. The recommendation with regard to the M'Art's Fort extensions was adopted by the casting vote of the chairman, and this, with the other extensions already agreed to, was ordered to be submitted to the Council.

**Bradford.**—During the past year an extended trial has been given on one of the tramcars in the service of the Corporation to a life-guard invented by Mr. Burton Smith, of Cottingley, an employé of the Bradford Tramways. The invention causes the platform to fall completely down to the ground when required, whilst a simple device locks it firmly in that position, so that nothing can get underneath it. The usefulness of the invention was demonstrated when a car ran into a boy, who was safely caught on the life-guard none the worse for his exciting experience.

**Brazil.**—American Vice-Consul-General J. J. Slechta reports from Rio de Janeiro that the President of Brazil recently laid the corner-stone of one of two 32,000-H.P. electric power stations which are to furnish the motive power for an electric railroad between the port of Victoria and the city of Itabira, in the State of Minas Geraes. The railway will be about 400 miles long, and will tap one of the greatest sources of Brazil's wealth in iron ore. One of the large waterfalls on the River Doce will furnish the power for one of the stations, and a large waterfall on a tributary stream will drive the second station. At Itabira it will connect with the Central of Brazil Railway, with which it will have mutual traffic agreements. It is expected thus to land at least 3,000,000 tons of ore annually at Victoria at an estimated cost for transportation of about four-tenths of a cent per ton-mile. About 250 miles of an existing steam railroad are to be utilised for this railway, the gauge to be changed from narrow to standard. The electrical equipment is to be furnished by a large British concern, the entire project being financed by British capital interested in the development of the iron-ore deposits.

**Canada.**—TORONTO.—The *Daily Telegraph* states that the experts who were appointed to report as to the practicability of constructing a system of underground railways in the city of Toronto say that a complete system of three tubes radiating from the centre would cost £4,600,000 to build, and could not be expected to pay at first, though before the expiry of the Street Railway franchise in 1921 the system would be self-supporting. "For various reasons, the city cannot at present face with equanimity such an addition to her expenditure. Toronto has just now more than one large project on the stocks. Her trunk sewer, water filtration plant, and civic electrical service are to cost something like £1,800,000. For the moment the 'tubes' must wait."

**Continental Notes.**—TURKEY.—It is announced from Constantinople that an agreement has now been arrived at between the Turkish Ministry of Works and the management of the Constantinople Tramways Co. in regard to the question of the conversion of the lines to electric traction, and the agreement is on the point of being signed. The execution of the work will render necessary various expropriations of property, and the company is required to pay £T.130,000 for this purpose. The company undertakes to pay to the city prefecture a fixed rate for the supply of energy per unit, and the annual sum is not to be less than £3,000. In the event of the net receipts of the tramways exceeding 6 per cent. of the share capital, the surplus is to be divided between the prefecture and the company, which is reported to have already made a large reduction in passenger fares.

ITALY.—The Ministry of Public Works has approved the plans of the "Società Italiana per le Strade Ferrate del Mediterraneo" for a railway from Umbertide to Terni *viâ* Todi; granted the application for a concession for the construction and working of an electric railway from Argegno to Lanzo d'Intelvi; and reported favourably on the proposal to link up the Iseo-Rovato railway with the Milan-Venice line, and on the application lodged by the "Società Edison" for the construction of an electric tramway from Affori to Varedo, this being an extension of the Milan-Affori tramway.—*Board of Trade Journal.*

La Société des Chemins de Fer Napolitains is reported to be considering a project for the conversion of its railways in the Naples district to electric traction.

GERMANY.—A concession has recently been granted for the construction of an electrical tramway between Burkheim and Oggersheim, Bavaria. The municipal authorities of the first-named town are interested in the scheme.

AUSTRIA.—Plans are being prepared in respect of a projected electric tramway in the town of Smichow, Bohemia.

SPAIN.—Don Mariano Gual, Count of Ayamans, and Don Alfonso Chopitea have applied for a concession for the construction and working of an electric tramway from C'as Catalá to Palmas station (Balearic Islands).—*Board of Trade Journal.*

**Dundee.**—The Tramways Committee has decided that only the necessitous blind will in future be granted free passes on the cars, the present free tickets to nurses, Salvation Army officers, &c., being withdrawn. In lieu of the passes a grant of £50 will be made to the Infirmary.

**East Ham.**—A letter has been received from the Barking U.D.C., with reference to the expiration of the agreement for the running of the East Ham cars in Barking on November 17th next, and inquiring whether East Ham has any suggestions to make as to a scheme of interrunning between the tramway systems of West Ham, East Ham, and Barking. The East Ham Tramways Committee has left the matter in the hands of the engineer and manager to negotiate and report upon.

**Halifax.**—The Corporation Tramways Committee on September 23rd received a deputation from Barkisland, Soyland, Rishworth, and Elland District Councils advocating the extension of the tramways to Ripponden and Elland. Mr. Spencer, chairman of the Committee, stated that having to transmit energy to long distances caused a loss in voltage, while there was also the question of the maintenance of the roads. District Councils could not legally relieve the tramways from paying rates, but they could do it in another way, and that was by paying an annual subsidy. He informed the deputation that that was the basic principle upon which the Corporation would be prepared to negotiate with the local authorities. The Tramways Committee would start from that point, and the question of the amount of the subsidy could be determined by negotiation.

**Keighley.**—The T.C. has resolved to promote a Bill authorising railless trolley vehicles for a number of routes in the district.

**Kent.**—It is proposed to construct a light railway between Headcorn and Maidstone, at a cost of £129,000. The Hollingbourne Council is considering the question of contributing £5,000 towards the scheme.

**London.**—L.C.C.—The Council has decided that necessitous blind persons properly authenticated, and accompanied by a guide, be carried free on the Council's tramcars, and that the guide be charged the usual fare. Free passes are issued to authorities of institutions at which such blind persons live or are employed, by the Chief Officer of Tramways.

On Friday last the District Railway brought into use a new system of fog signalling, which acts automatically in conjunction with the ordinary signals; a magazine charged with detonators is provided, and these are laid on the rail when required by a mechanical device.

On October 3rd the London Tube Railways will add to the number of their non-stop trains, generally accelerate the speed, and provide for shorter stops at stations. The lifts will be put in connection with the track, so that liftmen may better know of the approach of trains.

**Mexico.**—H.M. Minister at Mexico city reports the publication of two contracts between the Mexican Government and the Compania de Tranvias de Mexico for the construction of electric railways, as follows: (1) From Ixtapalapa, a suburb of Mexico city, to Puebla, a distance of 160 km. (about 100 miles), and (2) from Santa Fé, another suburb of Mexico city, to Toluca, a distance of 52 km. (about 32 miles). These railways will be in direct connection with, and will form an extension of, the electric tramway system already in operation throughout Mexico city and the adjacent suburbs. Surveys for each line must be begun within six months from August 24th; 5 km. of the line must be completed within two years, and the whole line within ten years. The gauge of both lines is to be 1·435 metres. Construction materials, &c., for the work may be imported free of duty for five years. The address in Mexico city of the "Compania de Tranvias de Mexico, S.A.," which is a Canadian company, is Indianilla, Mexico, D.F.—*Board of Trade Journal.*

**Scarborough.**—The Scarborough Tramways Committee has given notice of its intention to cease running the cars at Scarborough during the winter months commencing October 15th.

**Southend-on-Sea.**—The Tramways Committee of the T.C. has under consideration a comprehensive scheme for extending the tramways, including an application for a line to Hadleigh. A six months' trial of meters for detecting waste of energy on tramcars through careless or inefficient driving is to be made.

**U.S.A.**—According to newspaper reports, 46 people were killed and a number of others seriously injured in a collision between two electric trolley cars on a short curve of the Wabash Valley line. One car was going at 40 and the other at 25 miles an hour.

**Watford.**—A long discussion took place at the last meeting of the U.D.C., upon a proposal that the clerk be instructed to prepare a case opposing the Herts County Council's proposed Parliamentary Bill, in which it is intended to obtain powers to install the railless traction system through Watford. In the result it was decided to proceed to the next business. It was mentioned that the Metropolitan Tramways Co. are bearing the whole of the expense of sending a deputation from the Council to Berlin and Vienna to see the railless system working in those cities.

**West Ham.**—Twelve additional cars of the bogie type are to be obtained by tender in the usual way. Application is to be made to the B. of T. for sanction to a loan of £11,000 for the estimated cost.

**Weymouth.**—The T.C. has resolved to apply for electric tramway powers.

## TELEGRAPH and TELEPHONE NOTES.

**Atlantic Cable Licences.**—Notice is given in the *London Gazette*, by the Board of Trade, that the American Telegraph and Cable Co. and the Western Union Telegraph Co. have applied for the renewal of their licence to maintain and use at Sennen Cove, Cornwall, two telegraph cables from America, and for a licence to lay down two additional cables. The applications will be considered on October 22nd, and any objections to them should be lodged before that date.

**Submarine Cable.**—A concession has been granted by the Government of Costa Rica to a British subject for the establishment and working of a submarine cable between Colon and Limon. The right to establish one wireless telegraph station in the Republic is also granted. The name of the concessionaire may be obtained by British firms from the Commercial Intelligence Branch of the Board of Trade.

**Wireless Control of Vessels.**—According to the daily Press, successful experiments have been made near Nuremberg with a motor-boat controlled by electric waves, on a system devised and carried out by two Germans—C. Wirth and C. Beck.

**Wireless Telegraphy.**—With the aid of a kite to support the antenna, Mr. Marconi has succeeded in receiving signals from Clifden and Glace Bay on board the Italian Lloyd steamship *Principessa Mafalda*, at distances up to 3,500 miles, in broad daylight.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Austria-Hungary.**—October 1st. A copy of the specification issued by the municipal authorities of Mostar, for tenders for the installation of plant for the supply of electricity to the town, has been received in London from the British Consul. Tenders should be addressed to the Stadtmagistrat, Mostar, Bosnia-Herzegovina. The specification (in German) may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

**Australia.**—October 4th. Telegraph and telephone insulators for the P.M.G.'s Department in all States. See "Official Notices" August 12th.

October 4th.—Telegraph and telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" August 19th.

October 4th.—Telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" August 19th.

October 5th.—5,000 porcelain insulators, for the P.M.G.'s Department in New South Wales. See "Official Notices" August 19th.

October 17th.—Telegraph and telephone material, for the Deputy Postmaster-General, Hobart. Commonwealth High Commissioner's Office, 72, Victoria Street, London.

VICTORIA.—Telephone cable and insulators, for the P.M.G.'s Department in Victoria. See "Official Notices" September 2nd.

MELBOURNE.—H.M. Trade Commissioner for Australia (Mr. C. Hamilton Wickes) reports that tenders will be received at the office of the Deputy Postmaster-General, Melbourne, as follows:—October 18th, for 23 miles of telephone cable (Schedule No. 284), and 500 composition insulators (Schedule No. 374); October 25th, for 10,000 Cordeau insulators (Schedule No. 373).

TASMANIA.—October 17th. Telegraph and telephone instruments and material, for the P.M.G. See "Official Notices" September 2nd.

MELBOURNE.—October 25th.—Deputy Postmaster-General. Electric lighting material (Schedule No. 311). Deposit required with each tender. Local representation necessary. For copies of the specification and form of tender apply to the High Commissioner in London for the Commonwealth of Australia, 72, Victoria Street, S.W., where preliminary deposits may be paid.

November 2nd.—1,000 25-C.P. metallic-filament lamps. for 110 volts, D.C., for the P.M.G.'s Department in New South Wales. See "Official Notices" to-day.

November 2nd.—Insulators, covered wire, phosphor-bronze wire, and galvanised-iron stranded wire, for the P.M.G.'s Department in Queensland. See "Official Notices" to-day.

November 23rd.—Cable, ironwork, pipes, conduits, switchboards, telegraph and telephone instruments, &c., for the P.M.G.'s Department in Queensland. See "Official Notices" to-day.

**Balearic Isles.**—November 19th. The Spanish Ministry of Public Works (Ministerio de Fomento), in Madrid, is inviting tenders for the concession for the construction and working of an electric tramway between C'as Catala and the station at Palma in the Balearic Isles.

**Birkenhead.**—October 5th. Electrical sundries, &c., for a year, for the Mersey Railway Co. J. Shaw, general manager and secretary, Central Station, Birkenhead.

**China.**—SHANGHAI.—October 10th and 20th. The *North China Herald* of August 12th contains a notice to the effect that tenders are invited by the Shanghai Electricity Department for the supply of the following:—(1) Electric heating and cooking appliances (tenders October 10th); (2) 10,700 carbon-filament lamps (tenders October 20th); (3) 15,000 metallic-filament lamps (tenders October 20th). Sealed tenders, marked "Tender for Heating and Cooking Appliances," or as the case may be, should be addressed to the Acting Secretary, Council Rooms, Shanghai. Conditions, specifications and forms of tender may be obtained from the Electrical Engineer, Electricity Works, 31, Fearon Road, Shanghai, on payment for each specification of 10 taels, which will be returned on receipt of a *bona fide* tender.—*Board of Trade Journal.*

**Edinburgh.**—October 10th. Steam turbines, A.C. generators, condensing plant, and internal parts of cooling towers. See "Official Notices" September 16th.

**Egypt.**—October 20th. Electrical installation and refrigerating plant, for asylum at Khanka. Specification from Chief of Administrative Service, Public Works Department, Cairo; for particulars as to tendering see *Board of Trade Journal.*

October 31st.—According to the *Standard*, tenders are invited by the Ministry of the Interior, Cairo, for the supply and installation of machinery, &c., required for the establishment of water supply and electric light systems in the town of Beni-Souef. Tender forms obtainable from Mr. A. L. Webb, C.M.G., Queen Anne's Chambers, Westminster, S.W. The specifications, drawings, &c., may be obtained on payment of 200 piastres (£2 1s.). A deposit equal to 2 per cent. of the value of the offer is required with each tender.

**France.**—November 1st. The Prefect of the Department of the Yonne, at Auxerre, is inviting offers for the construction of a system of metre-gauge electric or steam railways in the Department, the aggregate length of the proposed lines being about 233 kilometres.

**French Congo.**—October 14th. The *Moniteur Officiel du Commerce* (Paris) contains a notice inviting tenders for the supply and laying of a submarine cable between Libreville and Loango (Pointe Noire). To qualify tenders a provisional deposit of 50,000 francs (£2,000) will be required, to be increased by the successful tenderer to 100,000 francs (£4,000). Tenders to the "Bureau de l'Ingénieur Chef des Etudes, Ministère des Colonies, Rue Oudinot No. 27," Paris.—*Board of Trade Journal.*

**Glasgow.**—Tenders are being invited for the carrying out of electric lighting and power installations at the various sections of the Scottish Exhibition, to open in Glasgow in the Spring. The chief engineer is Mr. Andrew Crichton Freeman, 499, Sauchiehall Street, Glasgow.

**Halifax.**—October 17th. One 1,500-KW. turbo-alternator with condenser, two 750-KW. rotary converters with transformers, and switchboard and platform, for the Corporation Electricity Department. See "Official Notices" to-day.

**Isle of Thanet.**—October 1st. Supply of general stores for the year for the Isle of Thanet Electric Tramways and Lighting Co., Ltd. See "Official Notices" September 16th.

**Johannesburg.**—November 4th. Five electric tramcars for the Municipality. Tenders to Town Clerk. Specification, &c., to be seen at Commercial Intelligence Department of the Board of Trade, London.

**London.**—HACKNEY.—October 13th. 90,000 pairs of white open-type arc-lamp carbons, for the Electricity Department. See "Official Notices" September 23rd.

L.C.C.—October 5th. Electrical installations at Coroner's Court, Poplar, and Hoxton House Schools, Shoreditch. See "Official Notices" September 23rd.

October 12th.—Electrical installation at the Sherington Road Central Elementary School, Greenwich, S.E. See "Official Notices" to-day.

**Margate.**—October 17th. Dust destructor, for the T.C. E. A. Borg, Borough Surveyor, 13, Grosvenor Place.

**Metropolitan Railway.**—October 3rd. General stores, including a number of electrical items, for 12 months. W. H. Brown, secretary, 32, Westbourne Terrace, London, W.

**Mozambique.**—October 12th. The authorities of the Harbour and Railway at Lourenco-Marques, Mozambique, are inviting tenders for the supply of seven electrically-operated cranes, ranging in capacity from 1 to 10 tons.

**New Zealand.**—December 15th. Installations of wireless telegraphy at Doubtless Bay, Gisborne, Cape Farewell, Sumner and Bluff. See "Official Notices" August 5th.

**Spain.**—Tenders have lately been invited by the municipal authorities of Campdevano (province of Gerona) for the concession for the electric lighting of the town during a period of five years.

**Taunton.**—October 3rd. 2,500 tons of smokeless steam coal, for the electricity works. G. H. Kite, Town Clerk.

**West Ham.**—October 13th. Electric light installation in the Receiving Homes, Aldersbrook Road, Wanstead, N.E., for the West Ham Union. See "Official Notices" to-day.

**York.**—October 7th. Carbons, carbon brushes, incandescent lamps, meters, motors and accessories, for the Electricity Department. See "Official Notices" September 23rd.

## CLOSED.

**Australia.**—Sydney.—The *Australian Mining Standard* reports that the Electric Lighting Committee has accepted the tender of W. T. Henley's Telegraph Works Co., Ltd., for the supply of 36,000 zinc cable suspenders, at £216. It has also been decided to accept Messrs. Noyes Bros.' tender of £5,317 for 15 miles of 11,000-volt cable, delivery to take place within 13 weeks; Messrs. Ferranti's, Ltd., of £2,593, for Section "A" switchgear and transformers (10,000-volt); and also the tender of the Australian General Electric Co., at £232, for Section "B" switchgear and transformers.

**Barnsley.**—The T.C. has accepted the tender of Messrs. Heenan & Froude for a three-cell refuse destructor. The estimated cost is £5,360.

**Belgium.**—Eight concerns—two Belgian, three German, two Swiss, and one American—submitted tenders to the municipal authorities of Ixelles, near Brussels, for the establishment and equipment of an electrical sub-station, the lowest being that of the Société des Ateliers de Constructions Electriques, of Charleroi.

**Bexhill.**—Messrs. Stephenson, Clarke & Co.'s tender for 1,000 tons of Shipley peas, at 16s. 4d. per ton, for the electricity works, has been accepted.

**Chelmsford.**—The Education Committee has, by 11 votes to 4, accepted the tender of the Banbury Electricity and Motor Co. for wiring Trinity Road Schools for lighting by electricity, and providing lamps, fittings, &c., at £174 15s., subject to modifications in the specifications as will, if possible, ensure a reduction in the cost.

**Chippenham.**—The School Governors have accepted the tender of Messrs. Edwards & Armstrong for apparatus for lighting the chemical laboratory and gymnasium by electricity.

**Coventry.**—The Corporation has placed an order (repeat) with Messrs. Ed. Bennis & Co., Ltd., for the supply of four sets of "Bennis-Miller-Bennett" patent chain-grate stokers for B. & W. boilers at the electricity works.

**Dudley.**—The Education Committee has accepted the tender of Messrs. Whittaker Bros. for the electrical equipment of new schools at Holly Hall.

**Germany.**—The Siemens-Schuckertwerke Gesellschaft, of Berlin, has secured a contract for the establishment of a central electric lighting station in the town of Ostenfeld (Schleswig).

The Augsburg Maschinenfabrik Gesellschaft, of Nuremburg, submitted the lowest tender to the harbour authorities at Hamburg for the supply and erection of 10 electrical cranes.

**Grimsby.**—The T.C. has accepted the tender of Messrs. Browne & Son for 10,333 tons of Shirebrook coal for the electricity works, at 6s. 2d. per ton.

A tender for metallic-filament lamps for street lighting, at £15 per gross, has been accepted by the T.C.

**Heckmondwike.**—The U.D.C. has accepted the tender of its own electrical engineer for wiring and electrical fittings for lighting the cemetery lodge.

**London.**—Westminster.—The City Council has accepted the tender of Messrs. Speedy, Eynon & Co., at £47 10s., for wiring for additional lights in the large hall of the Caxton Hall, and also re-wiring consequent upon certain alterations; also for altering the positions of the wires, switches, fuse-boxes, &c., adjoining the entrance to the large hall, at £45.

Battersea.—The B.C. has accepted the tender of Messrs. Pooley and Austin to provide a switchboard, &c., at £120.

**India.**—The Globe Electric Co., Ltd., have just received a further order for 24 "Multax" lamps for the Bengal-Nagpur Railway, this making the third repeat order during the present year.

**Luton.**—The T.C. has accepted the tender of the Alphons Custodis Chimney Construction Co., Ltd., for a shaft at the refuse destructor, at £947.

For the supply of coal for the electricity works for a year, the following tenders have been accepted by the T.C.:—

Mr. C. Franklin, Luton.—2,500 to 3,000 tons of Cossall slack, at 10s. 9d. per ton, or 9s. 11d. if in the Corporation trucks.
Mr. G. Newbold, Luton.—2,500 to 3,000 tons of Whittick slack, at 9s. 9d. per ton, or 8s. 9d. if in the Corporation trucks.

**Radcliffe.**—The U.D.C. has accepted the tender of Mr. W. Brierley for the electric light installation at the new Council offices.

**Swansea.**—The Harbour Trust has accepted the tenders of the British Westinghouse Electric and Manufacturing Co. and Messrs. Crompton & Co., Ltd., for electrical plant at the dock.

**West Ham.**—The T.C. has accepted the following tenders, the price in each case being the lowest received:—

New Conveyor Co.—Ash elevator, generating station, £315.
Aiton & Co.—Cast-iron piping and valves, generating station, £163.
Bruce Peebles & Co.—Motor for centrifugal pump, generating station, £125; also motor-generator, external system, £152 10s.
W. H. Allen & Co.—Centrifugal pump, generating station, £121.

The Council has exercised an option and placed an order with Messrs. Pirelli, Ltd., for six months' supply of india-rubber wires and cables.

## FORTHCOMING EVENTS.

**Institution of Mechanical Engineers (Graduates' Association).**—Monday, October 10th, 1910. At 8 p.m. "Recent Improvements in Wood-working Machinery," by Mr. Albert E. Harris, graduate, of London.

## NOTES.

**Extra High Pressure in Canada.**—Recently the Hydroelectric Commission's double transmission line from Niagara Falls to Dundas, and the single line from Dundas to Berlin, were put through a test under 165,000 volts. The chairman of the Commission stated on the following day that the test showed unmistakably that power could be safely transmitted at the high voltage, which was 55,000 volts higher than the regular voltage of the line when in continuous operation by the Commission, which will be 110,000 volts. This test, he said, means that power will be transmitted and supplied to the various municipalities at a price much lower than was named in the estimates made by the Commission some years ago. The whole of the transmission line will be finished and in operation before the end of this year.—*Electrical World.*

**Electric Ploughing.**—The Swedish electrical company, Allmänna Svenska Elektriska Bolaget, of Västeras, has developed a new electric plough, which will cost only 10,000 kr. to make, as compared with five times that price for the imported machines.—*Affärsvärlden.*

**Electricity v. Gas at Chelmsford.**—At a meeting of the Chelmsford Educational Committee held at Chelmsford on Tuesday, September 20th, tenders were received for the supply of lamps, fixtures, &c., and for fixing wiring, &c., for lighting the new Trinity Road School by electricity and alternatively for the supply and fixing of pipes, lamps, &c., for lighting the school by gas. There were 13 tenders, and these were considered by a sub-committee, which, after due deliberation, recommended that in view of the general convenience, utility and cleanliness of electricity, electric lighting be adopted, although the lowest tender was for gas lighting, and that the lowest tender for electric lighting, namely, that of the Electrical and Motor Co., of Banbury, be accepted. In the discussion which followed this recommendation, Councillor T. H. Waller—who, by the way, is a medical man—said that the point which influenced him in voting for electric light was that of improved atmosphere, and Ald. S. G. Bond said that he supported the electric light because, at times, the smell from the gas by-passes in St. John's Church was abominable—in fact, was as bad as any sewer, while the chairman, Ald. G. W. Taylor, said the sub-committee had considered the matter most carefully, and were guided by their personal experiences with both gas and electric light; he, personally, would never dream of putting gas into any modern school, and he would remind them that not long ago they took gas out of the Friars School and put in electric light. On the resolution in favour of electricity being put to the meeting, it was carried by 11 votes to 4.

**I.M.E.A. Bill.**—We are informed that the following towns have signified their intention of supporting the Bill :—Ayr, Wakefield, Northampton, Chester, Shrewsbury, Radcliffe, Burnley, Leytonstone, Sunderland, St. Anne's-on-Sea, Bexley Heath, Manchester, Blackburn and Hounslow.

**X-Ray Victim.**—It is stated that the Government have made a grant of £150 to Mrs. Cox, widow of Mr. Harry Cox.

**Educational.**—CITY AND GUILDS TECHNICAL COLLEGE, Finsbury, E.C.—The 1910-11 session for evening classes commences on October 3rd. Lectures and laboratory work, mechanical and electrical engineering, industrial and technical chemistry, &c. A special course of six lectures on "India-rubber" will be given by Dr. P. Schidrowitz, commencing on October 12th. Programme from the College, or from the head office of the City and Guilds Institute.

**Appointments Vacant.**—Third engineer-in-charge, for Bermondsey Council (£110); fitter for the Willesden workhouse infirmary (36s.); electrical engineer, to take charge at the County Asylum, Rainhill (£120); correspondence clerk, for the Swindon Corporation Electricity and Tramway Departments (£50); laboratory demonstrator in the Electrical Engineering and Applied Physics Department of the Northampton Polytechnic Institute (£100); junior shift engineer for the Pontypridd U.D.C. (30s.); collector for the Sheffield Corporation Electricity Supply Department (£120). See our advertisement pages in this issue.

**Institution and Lecture Notes.**—INSTITUTION OF CIVIL ENGINEERS.—The Council has made the following awards in respect of students' papers read during the session 1909-10 :—The "James Forrest" Medal and a Miller Prize to Mr. H. T. Tudsbery, and Miller Prizes to Messrs. L. T. Wilson, L. St. G. Wilkinson, B.Sc., S. G. Gladwyn, A. J. Hart, V. M. Barrington-Ward, B.Sc., T. W. W. Parker, A. E. Fletcher, B.Sc., and E. L. Leeming, B.Sc.

IRON AND STEEL INSTITUTE.—The autumn meeting was held this week at Buxton, the Duke of Devonshire presiding.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—A special meeting of all engineers interested in the application of electricity in mining will be held at the Royal Hotel, Dunfermline, to-morrow at 6 o'clock, to consider the inauguration of a branch of the Association in the East of Scotland, and to appoint a committee.

**Corrosion of Boiler Tubes.**—The B. of T. issued recently the papers in connection with an inquiry held in regard to explosions which took place in June last at the Corporation electricity works, Whitehaven. From the report of Mr. G. W. Buckwell, the inspector who held the inquiry, it appears the boilers are of the Babcock & Wilcox type, and each contains 96 mild steel tubes, the bottom row being solid drawn, and the remainder lap-welded, each 16 ft. long, 4 in. in diameter, and ·144 in. in thickness. The makers of the tubes for the boilers cannot be traced, but the boilers were made by Messrs. Babcock & Wilcox, Renfrew, in 1900, and were erected in December of that year. The explosions appear to have been due to internal wastage of the tubes caused by the corrosive action of the feed water. Between 1901 and November, 1906, 13 tubes had to be replaced, in each case it is supposed owing to internal corrosion. From November, 1906, to December, 1909, 14 tubes gave way from a similar cause, *i.e.*, an average of about five a year. The circulating water for the condenser at the electricity works is taken from a small stream rather noted for its strong colour and smell, and into which it is supposed deleterious wastes drain from various works. When the town water supply had to be curtailed on May 4th owing to alterations being carried on at the waterworks, the water from the small stream beforementioned was utilised for feed water. Five days later the tubes in the two boilers began to give trouble. On the morning of June 7th, the blow-down pipe attached to a boiler fractured on the under side, the opening being about 2 in. long × ¼ in. wide, but it was impossible to get near it at the time to ascertain the extent of the damage, so the fires were withdrawn. At 2 p.m. the same day a tube in another boiler commenced to leak, the leakage increasing to such an extent that at 2.30 a.m. on the 8th, the fires were put out. The steam plant had been shut down at 12.30 a.m., as no lighting was required after that, and the injector was used continuously to keep the water level up in the boiler, but by 2.30 a.m. it failed to do so. In the meantime an examination of the first boiler had revealed two other defective tubes, in addition to the one which was known to have given way, and all these defective tubes were then being withdrawn from that boiler for replacement by new ones; both boilers were, unfortunately, laid off together, thus entirely preventing the use of the steam plant at the works. A third water-tube boiler had been in course of erection since the beginning of May, but it could not be finished in time to take up duty, otherwise the complete closing down of the works would have been avoided. The observations of the Engineer Surveyor-in-Chief of the Board of Trade are as follows :—"This report refers to small failures of tubes in water-tube boilers, owing to the corrosive action of feed water which at the time was not being obtained from the usual source. Feed water of good quality is essential for the satisfactory working of boilers, particularly of this type, and doubtless those responsible are aware of this; but the usual supply was not available at the time. Very serious explosions have occurred from tubes in which the corrosion is general. In this case only small holes formed in the tubes, and no person was injured; but the greatest care is necessary until the corrosion ceases."

**Address Wanted.**—Will Mr. J. W. Hazeldine, formerly a student at Bolton, or any reader acquainted with his whereabouts, kindly send his address to the Editors?

**Fatality.**—A telephone foreman, aged 63, met his death some days ago by falling from a Glasgow building through a glass roof on to machinery which was in motion, and in which he was caught.

**National Electrical Manufacturers' Association (Inc.).**—The half-yearly general meeting of this Association will be held at the Midland Hotel, Manchester, at 2.30 p.m., on Tuesday, October 11th next. A committee meeting is to be held at the same place on the same day at 11.30 a.m.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*

**Central Station Officials.**—The directors of the Northallerton Electric Light and Power Co., Ltd., have appointed MR. H. W. MILNES as engineer and manager, in succession to MR. F. R. BATTY, who, as already stated in this column, has taken up a post in London.

MR. H. F. BARNES has resigned his position as shift engineer under the Eccles Corporation, in order to take up a similar post under the Rawtenstall Corporation.

The E.L. Committee of the Stoke-on-Trent T.C. on Monday received 240 applications for the post of resident engineer at the Stoke Electricity Works, the salary being £180 per annum. Three applicants were selected to meet the Committee.

The staff of the Hanley Electricity Works have presented a case of Loewe pipes and a copy of Dr. J. W. Mellor's "Higher Mathematics," to MR. C. H. YEAMAN, on taking up his appointment as chief electrical engineer to the Federated Borough of Stoke-on-Trent.

An Australian contemporary says that MR. A. FRASER, of Melbourne, has been selected from a number of applicants to fill the position of engineer for the Korumburra municipal electric light works.

**Tramway Officials.**—The Bournemouth Tramways staff have presented a cheque to MR. A. H. BOWLES on his marriage.

According to the *Australian Mining Standard*, MR. T. M. NELSON, assistant engineer in the tramway department, Launceston (T.), was to vacate his position at the end of August, having been appointed electrical engineer to the Christchurch (N.Z.) Tramway Trust. MR. OSWALD CLANDSLEY, A.M.I.C.E., Lond., was selected to succeed him.

**General.**—Consequent upon his departure from Manchester, MR. LAURENCE H. A. CARR, M.Sc.Tech., has resigned the hon. secretaryship of the Manchester Students' Section of the I.E.E., and MR. R. G. PARROTT, of 63, Northumberland Road, Old Trafford, Manchester, has been appointed in his stead.

The *London and China Telegraph* states that MR. HAYASHI manager of the Kobé branch of the Osaka Shosen Kaisha, has resigned his office and joined the Ujikawa Hydro-Electric Power Co.

MR. A. S. E. ACKERMANN, B.Sc. (Engineering), A.M.Inst.C.E., of Westminster, has returned to London after an absence of 10 weeks in the United States.

The Board of Trade has appointed DR. ALEXANDER RUSSELL, M.A., M.I.E.E., principal at Faraday House, to be an electric inspector to Surbiton.

MR. J. M. M. MUNRO, having severed his connection with Messrs. Anderson & Munro, announces his intention to devote himself entirely to consulting work. Mr. Munro, whose address is 108, Douglas Street, Blythswood Square, Glasgow, has for many years specialised in electric lighting of mansion house and public buildings, electromotive power, water-power, town and district lighting, &c.

MR. F. ARTHUR COUSE, engineer-in-charge at the West Bromwich Corporation Electricity Works, has been appointed as switchgear engineer by the British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester, and he takes up his duties on Monday next.

**Obituary.**—We regret to learn that MR. GEORGE ALEXANDER MASON died at Bahia Blanca, Argentine, on September 23rd of typhoid, aged 32 years. He was in the employ of the Buenos Ayres and Pacific Railway Co., having gone out to Bahia Blanca in January, 1909. His apprenticeship was served with Crompton & Co., Chelmsford, and he had also been with the B.T.-H. Co., Rugby, The Brush Electrical Engineering Co., Loughborough, and the Corporation Electricity Works, Grimsby. He served for 15 months with the Corps of Electrical Engineers in the South African War. Mr. Mason was a brother-in-law of Mr. W. A. Vignoles, the borough electrical engineer of Grimsby.

## CITY NOTES.

### British Thomson-Houston Co., Ltd.

Mr. J. F. Nauheim presided on Wednesday over the fifteenth ordinary general meeting of the above company held at the offices, 83, Cannon Street, E.C.

In moving the adoption of the report (see Electrical Review, page 509), the Chairman said that whilst it showed a distinct improvement over those of previous years, yet it was disappointing, inasmuch as the net profit did not allow of the payment of a dividend on the share capital. The disadvantages under which the electrical industry had laboured for a number of years still continued, and the company had to meet severe competition both at home and abroad, so that the prices obtained were, generally speaking, unremunerative. It was only by paying the strictest attention to every detail, and by great economy, that they were able to meet these things. The present year showed signs of a fairly satisfactory progress with the business of the company, and they had every hope that next year they would be able to show better profits. Turning to the accounts they would see that £3,339 had been paid in redemption of debentures. They owed the General Electric Co., £174,000, against £161,000 last year. Sundry creditors were £120,000, as compared with £122,000. On the credit side, patents, licences and goodwill, remained the same. The capital expenditure amounted in all to £510,515, against £478,610 last year. The expenditure under that head would be still further increased, as would be seen from the report. The net cost of the Rugby factory was £504,203, after writing off £6,312 this year. They had been able to reduce their holding in shares in other companies from £150,518 to £86,074, which they regarded as satisfactory. The profit and loss account showed that there was a net profit of £10,938, as against the fact that they showed a small loss in the last report. The whole of the money, with the exception of £248 carried forward, had been used in writing off various items.

Mr. H. C. Levis seconded the motion, and the report was adopted.

### Manila Electric Railroad and Lighting Corporation.

The following is a comparative statement of earnings and expenses for three years for 12 months ending December 31st :—

| | 1907. | 1908. | 1909. |
|---|---|---|---|
| Gross earnings .. .. .. .. .. | $978,863 | $1,127,341 | $1,141,689 |
| Operating expenses .. .. .. .. | 491,377 | 576,849 | 600,570 |
| Net earnings .. .. .. .. .. | $487,486 | $550,492 | $541,119 |
| Fixed charges (including sinking fund).. | 271,279 | 298,307 | 300,095 |
| Surplus .. .. .. .. .. .. | $216,207 | $252,185 | $241,024 |

The corporation, which was incorporated in 1903, and which has an issued capital of $5,000,000 with a bonded debt of $5,512,000, owns (1) the entire stock and bonds of the Manila Electric Railroad and Light Co., (2) all the capital stock of the Manila Suburban Railways Co., and (3) more than 98 per cent. of the capital stock of La Electricista, a Spanish company conducting an electric lighting business in Manila. The Manila Electric Railroad and Light Co. is the owner of a 50-year franchise, granted in March, 1903, by the municipality of Manila, and operates all the electric railways in Manila, in which city it is also authorised to carry on a general electric lighting business. The Manila Suburban Railways Co. has a 47-year franchise from January, 1906, and its lines are a part of the system of the Manila Electric Railroad and Light Co., providing connecting links to the suburbs with that company's system. Manila is the social, political and business centre of the Philippines. It has a population of about 300,000, and transacts about 80 per cent. of the entire commerce of the Archipelago. The profits fell off slightly in the first half of 1909, owing to a strike which was successfully overcome after lasting a considerable time, but they recovered substantially in the corresponding period of the current year. The corporation paid 3 per cent. on its common stock for 1906 and 1907, and 4 per cent. for each of its following years. During 1910 a distribution of 1 per cent. per quarter has been made.

### United Electric Car Co., Ltd., Preston.

The annual meeting of this company was held on Wednesday last week at the offices, Preston. Mr. G. Richardson presided, and, in moving the adoption of the directors' report, said the result of the year's working was most satisfactory, in view of the continual slackness of the works, and the small output, although they had received a good share of any work which had been given out and was worth having during the year. The net profit, after allowing for depreciation, debenture interest, and all charges, was £8,478, or only about £400 less than last year, which showed that the orders they had carried out had been profitable. The balance to be disposed of amounted to £10,812, and the directors considered they were justified in declaring a dividend of 2½ per cent. on the ordinary shares, less income-tax, as last year, leaving £4,062 to be carried forward. Every economy had been made, and the expenses kept down in all departments to the lowest possible point short of affecting the interests of the company. Their financial position continued to be very strong, their liabilities to creditors amounting only to £17,699, and cash at bankers, investments and debtors to £125,000. That strong financial position, while being in a way a misfortune, inasmuch as it had been brought about through scarcity of work, on the other hand put them in an excellent position to take large orders when due opportunity occurred; also, as pointed out last year, to buy on the very lowest cash terms. They had again added £4,500 to their depreciation reserve, which now stood at £39,000. That was a very substantial reserve in view of the excellent state of the buildings and machinery. He was glad to say they saw signs that their reputation for good work was extending, and had become established both at home and abroad, and that was borne out by repeat orders they had received, as well as some small orders from countries not previously solicited; that was entirely owing to the satisfactory and high-class work they had turned out, and they were hopeful that before long they would see a general resumption of demand from abroad for their products. They were also hopeful that English corporations and others might soon be in the market, as many of the cars in use had now been running eight or ten years, and they did not think that large corporations, as a rule, would find it convenient or advisable to build their own. In his remarks last year he did not hold out any better prospects, and he regretted that at the present time there was no sign of any immediate improvement.

### Willans & Robinson, Ltd.

The directors' report for the half-year ended June 30th, 1910, states that, after writing off the sum of £4,422 as depreciation, paying £4,217 interest on debenture stock, and £593, the cost of the upkeep of the Queen's Ferry Works, the result of the half-year's trading shows a loss of £8,002. Added to the balance £7,267 brought forward from the previous half-year, this brings up the total of the debit standing against the profit and loss account to £15,269. Debentures representing £6,104 have been redeemed during the half-year out of the fund set aside for that purpose, and having been purchased at a discount the profit on the transaction has been transferred to the reserve fund. The unsatisfactory result for the half-year under consideration is due to the low prices prevailing and the scarcity of orders obtainable during the whole of the year 1909. There has, however, been a steady improvement in the volume of orders booked during the present year, but although the amount of work in hand is now fairly satisfactory and orders are continuing to come in at an increasing rate, yet the prices obtainable are on even a lower scale than for the year 1909, and until there is a material improvement in this respect it will not be possible to show a profit. Every effort is being made to reduce costs so as to leave a margin on the selling prices. Important improvements have recently been introduced in the steam turbines made by the firm. These improved turbines are showing extremely good results in working and their merits will, undoubtedly, lead to increased sales. The agreement with the Diesel Engine Co. has been terminated and the company is free from October 1st to sell Diesel engines in any quarter required —a business that will be vigorously pushed. The directors are doing everything that is in their power to carry the company through the present very difficult times and only regret that they have to call on the shareholders for a further instalment of patience. With regard to the item set down in the balance-sheet as the value of the Queen's Ferry Works, as the directors have intimated more than once to the shareholders, there will probably be a considerable book loss when the property is sold. This forecast holds good to a minor extent in regard to the premises at Thames Ditton. The purchase of the Queen's Ferry Works is at present under option to a syndicate, for which option a substantial sum has been paid. Should the option to purchase be exercised, the sale should be completed within the next few months. The amount of the loss will then be ascertained and the item will disappear from the balance-sheet. As provision against this contemplated loss there is on the other side of the balance-sheet a reserve fund amounting to £44,644.

### Underground Electric Railways Co. of London, Ltd.

The Rt. Hon. Sir Edgar Speyer presided on Wednesday of last week over the tenth ordinary general meeting of this company, held at Electric House, Broadway, Westminster.

The Chairman, in moving the adoption of the report (see Elec Rev., August 19th, page 307), said he was glad to be able to record results which, although not yet satisfactory, were considerably better than was anticipated several years ago. The dividends paid on the share capital of the railway companies did not yet represent anything like a fair and adequate return on the large amount of money invested in these enterprises. As regarded the accounts, the interest items, compared with the corresponding period of the previous year, showed a credit of about £11,500. This was mainly due to the interest on the unpaid calls, to the higher bank rate prevailing, and to the conversion of the power house debentures. Administration expenses showed a saving of over £4,000. The increase in the income from the operation of the power house was due to £3,000 interest on increased expenditure (of which £2,500 referred to the period ending December 31st last), and the balance of £1,700 represented additional profit. The income from investments increased by nearly £13,000. This increase was due not so much to an expansion of traffic receipts, as to a reduction in working expenses of the London Electric Railway. This decrease in costs had been brought about almost entirely by a reduction in the price paid by that company for electric current, and was due to a modification in the power agreement between this company and the railway companies, by which their yearly contributions to the depreciation fund were reduced by about £15,000, and also to economies effected in the working of the plant by the introduction of more efficient turbines. The amount paid for wages on the railways had increased, but this increase was more than off-set by the savings just referred to. The increase in rents amounted to about £400, while the amount spent upon property for letting purposes decreased by about £700. There was

a growing demand for the company's available sites. With regard to the London electric railway traffic, they could not, in the nature of things, expect the same quick growth, and they must look forward to a somewhat smaller expansion of earnings than was the case during the first two or three years after the railways were opened. The Charing Cross line had to contend with the competition of the L.C.C. tramways, which, together with a reduction of fares on this railway, forced upon the company by the very low fares inaugurated by the L.C.C., had resulted in a decrease in the traffic receipts during the half-year under review. The L.C.C. tramways were electrified about a year ago, and it was expected that after November of this year the earnings on the Hampstead line would show an increase compared with the corresponding period. He referred at the last half-yearly meeting to the rejection of the extension scheme of the Charing Cross line by the House of Lords Committee. The London Electric Railway Co. was asking Parliament in the ensuing session for fresh powers to build this extension on modified plans. He thought he was justified in congratulating the shareholders on the passing of the London Electric Railway Amalgamation Act. The three tube companies had disappeared as separate entities, and were now known under the collective title of the London Electric Railway Co. He had referred in former speeches to the various advantages arising out of this amalgamation, and could only reiterate that it should result in economies in working and in higher credit. The Underground security holders would no doubt be glad that for the first time the revenue had been sufficient to pay a small dividend on the income bonds. The report had already informed them of the changes that had been made in the management, necessitated through the retirement of Sir George Gibb, in consequence of the Government appointment he had accepted. Sir George joined this company at a most difficult period, and he would like to express once more their sincere regret at losing him, and to bear testimony to the valuable services he rendered at that time when his great experience and knowledge of public affairs, as well as the confidence he inspired, had been of much assistance to the company. As they knew, Sir George had in Mr. Stanley a most able and efficient colleague, on whom the work of running the railways and of generally managing the system devolved, and no praise could be too high for the manner in which he had acquitted, and was acquitting, himself of this difficult task. He was sure that their enterprise could not be entrusted to more competent hands. The shareholders might also be congratulated on Lord George Hamilton's acceptance of the chairmanship of the District and London Electric Railway Boards. Lord George was such a well-known and distinguished figure in public life, that it was superfluous on his his part to attempt any further comment on the advantage of his appointment.

Lord George Hamilton seconded the motion, and the report was adopted.

## A Swiss-German Electrical Combination.

The process of concentration on the European Continent shows no indications of abatement, and the latest scheme represents a triple combination of Swiss and German interests which may possibly develop still further. About two years ago the question of an amalgamation of the Maschinenfabrik Oerlikon and Brown, Boveri and Co., of Baden, was raised, but any suggestions or proposals made in this respect did not materialise, and are not in contemplation at the present time. The project now under consideration relates to the establishment of a community of interests, by way of a beginning, between the Swiss Brown, Boveri & Co., and the Elektrizitäts Gesellschaft Alioth, of Arlesheim, on the one hand, and between the former and the German Isaria Zählerwerke Gesellschaft, of Munich, on the other.

The directors of Brown, Boveri & Co., in announcing the projected transaction, state that they have entered into an arrangement with the directors of the Alioth Electricity Co., whereby the former offers an exchange of shares to the shareholders in the latter company. The exchange has been so arranged that one new Brown-Boveri share of £50 is to be given for four Alioth preference or ordinary shares of £20 each, and the Brown, Boveri Co. reserves the right of withdrawing from the operation unless at least 7,200 shares, or 60 per cent., of all Alioth shares issued are notified for exchange. In the first place, the transaction only aims at the establishment of a community of interests between the two companies, but it should finally lead to a complete amalgamation with the continuance of existing manufacturing at Monchenstein. By means of this association not only will the possibility be afforded of unifying a now divided manufacture, and of giving it a more rational course, but above all, it implies the concentration of the financial groups of the two companies with the simultaneous adhesion of the Swiss Bank Verein, which already stood in connection with a Basle banking group of the Alioth Electricity Co.

At the same time the directors of Brown, Boveri & Co. have entered into an arrangement with the board of the Isaria Zählerwerke, whereby the shareholders in the latter company will be offered an exchange of their shares for new Brown-Boveri shares on the basis of share for share. By this means the Swiss company will become associated with new branches of manufacture in Germany, and thus extend its department from the mere machine business also to the manufacture of bulk products of the electrical industry, whilst the Swiss firm also secures new and valuable relations in South Germany, especially in the kingdom of Bavaria. On the completion of this exchange of shares, of which the stipulated minimum number of two-thirds of the Isaria works has already been assured, the latter will presumably be amalgamated with Brown, Boveri & Co., of Mannheim, the German subsidiary of the Swiss firm. The two transactions will render necessary an increase of £250,000 in the share capital of the Swiss Co., but in consequence of the general requirements it is proposed to raise the capital by £320,000 to £1,120,000, the difference of £70,000 being taken over by a banking syndicate.

The Alioth Co., which has been in existence since 1895, has a share capital of £240,000, which is divided equally into preference and ordinary shares, whilst bonds or debentures represent a further £200,000. In 1904, 1905 and 1906, the preference shares received a dividend of 5 per cent.; in 1907 the rate was 6 per cent., and the ordinary shares also participated to the extent of 4 per cent.; and in 1908 and 1909 the rate on both classes was 6 per cent. The Isaria Works were converted from a limited into a share company in April, 1909, with a share capital of £80,000, and a dividend of 10 per cent. was paid for the first year. The company is engaged on the production of electricity meters, gas meters, small electric motors, ventilators, instruments of precision, measuring apparatus, and switchboards, &c.

The pending transactions lend special interest to the report of the Brown, Boveri & Co., of Baden, to which reference was briefly made a short time ago. After paying 11 per cent. for four years in succession, the rate of dividend for 1909-10 has fallen to 8 per cent. The directors state that notwithstanding the improvement manifested in business for a time, sale prices had further fallen until recently, and price conditions were the most unfavourable in Germany. The means of production constantly experienced an extension, and at the same time every individual order was keenly contested. Even the fairly brisk activity of the works had not been able to prevent almost every new competition from resulting in the submission of cheaper offers. It was obvious that in this way any profits would ultimately be unobtainable, and only returning judgment all along the line could lead to an improvement. A further prejudice of the results was caused by the regularly increasing working expenses, but no equivalent for these additional expenses was afforded by the sale prices. Under these circumstances Brown-Boveri had to suffer probably more quickly, as the company restricted manufacturing to electrical and other machinery and almost exclusively fostered the business of customers, whilst the sale by closely associated undertakings was only nourished to the smallest extent. The accounts show the following figures for the past two years :—

| | 1909-10. | 1908-9. |
|---|---|---|
| Share capital ... ... ... | £800,000 | £800,000 |
| Bond capital ... ... ... | 400,000 | 400,000 |
| Depreciation provision ... ... | 25,000 | 22,000 |
| Net profits... ... ... ... | 80,000 | 105,000 |
| Dividend ... ... ... ... | 64,000 | 88,000 |
| ,, per cent. ... ... | 8 | 11 |

The prices of steam turbine sets were by far the lowest, and the company reduced the turnover in this department, whilst at the same time new and simplified types were worked out. The French company and its licensees, besides other important orders, had six large steam turbines each of 20,000 H.P., to build for the Paris Central Stations. A perceptible standstill had occurred in the construction of new power works in Switzerland, and the electrification of the railways in that country also showed no visible progress. A proposal which the company submitted for the electrical working of the Hauenstein line remained unconsidered. The Seethal Railway was now electrically operated for the largest portion of the section, and trial trips on the Martigny-Orsières section had begun, both being of normal gauge with single-phase working. A new electrical system was employed in particular on the latter, and two locomotives on the same principle were being built for the Wiesenthal Railway and the Prussian State Railway authorities, who manifested great interest in it, and had it in prospect for further works. Despite the reduced output of steam turbine sets, the works were fully employed throughout the year, and the total production, as well as the number of workmen employed, experienced an increase. The report also gives particulars of the subsidiary undertakings in other countries in which the company is interested.

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers during the four weeks ended July 29th, 1910, were 794,120, compared with 728,069 units in the corresponding four weeks of 1909. The figures for the four weeks ended August 26th, 1910, were 824,917, compared with 735,625 in 1909.

**Stock Exchange Notice.**—The Committee have appointed Wednesday, October 19th, to be a special settling day in Vera Cruz Electric Light, Power and Traction, Ltd.—£250,000 5 per cent. first mortgage debentures (Nos. A 1 to A 2,300 of £100, and B 1 to B 1,000 of £20 each), in lieu of the script.

**Belgium.**—The report of the Compagnie Electrique Anversoise, of Antwerp, for the last financial year, shows a profit of £48,142, as compared with £46,228 in the preceding 12 months. The dividend is being increased from 10 fr. to 10½ fr. per share.

**Anglo-Argentine Tramways Co., Ltd.**—The directors have declared an interim dividend of 3s. 6d. per share, less income-tax, being at the rate of 7 per cent. per annum, on the ordinary shares for the half-year ended June 30th.

**Mexican Light and Power Co., Ltd.**—The directors have declared a dividend of 1 per cent. on the ordinary shares for the quarter ending September 30th.

**Bank Rate.**—The Bank Rate was yesterday raised from 3 per cent. to 4 per cent.

## MARKET QUOTATIONS.

### Wednesday, September 28th.

| CHEMICALS, &c. | | Latest Price. | Fortnight's Inc. or Dec. |
|---|---|---|---|
| a Acid, Hydrochloric | per cwt. | 5/- | .. |
| a " Nitric | " | 22/- | .. |
| a " Oxalic | " | 28/- | .. |
| a " Sulphuric | " | 5/6 | .. |
| a Ammoniac, Sal | " | 42/- | .. |
| a Ammonia, Muriate (crystal) | per ton | £29 | .. |
| a " " | " | £30 | .. |
| a Bleaching powder | " | £5 10 | .. |
| a Bisulphide of Carbon | " | £18 | .. |
| a Borax | " | £16 | .. |
| a Ferro-Silicon (50 %) | " | £9 10 | .. |
| a Copper Sulphate | " | £18 | .. |
| a Lead, Nitrate | " | £25 | .. |
| a " White Sugar | " | £23 10 | .. |
| a " Peroxide | " | £32 | .. |
| a Methylated Spirit | per gal. | 2/6 | .. |
| a Potassium, Bichromate, in casks | per lb. | 3½d. | .. |
| a Potash, Caustic (75/80 %) | per ton | £20 | .. |
| a " Chlorate | per lb. | 3½d. | .. |
| a " Perchlorate | " | 4½d. | .. |
| a Potassium, Cyanide | " | 7d. | .. |
| a Shellac | per cwt. | 88/- | .. |
| a Sulphate of Magnesia | per ton | £4 10 | .. |
| a Sulphur, Sublimed Flowers | " | £6 10 | .. |
| a " Recovered | " | £5 10 | .. |
| a " Lump | " | £5 | .. |
| a Soda, Caustic (white 70 %) | " | £11 | .. |
| a " Chlorate | per lb. | 3½d. | .. |
| a " Crystals | per ton | £3 5 | .. |
| a Sodium Bichromate, casks | per lb. | 3d. | .. |
| a " Cyanide (basis 100 %) | " | 7d. | .. |
| **METALS, &c.** | | | |
| b Aluminium Ingots, in ton lots | per ton | £80 | .. |
| b " Wire, in ton lots | " | £112 | .. |
| b " Sheet, in ton lots | " | £120 | .. |
| p Babbitt's metal ingots | " | £38 to £145 | .. |
| c Brass (rolled metal 2" to 12" basis) | per lb. | 6¼d. | .. |
| c " Tube (brazed) | " | 8¾d. | .. |
| c " " (solid drawn) | " | 7d. | .. |
| c " Wire, basis | " | 6¼d. | .. |
| c Copper Tubes (brazed) | " | 9d. | .. |
| c " " (solid drawn | " | 8¾d. | .. |
| g " Bars (best selected) | per ton | £70 | £1 dec. |
| g " Sheet | " | £70 | £1 dec. |
| g " Rod | " | £70 | 1 dec. |
| e " (Electrolytic) Bars | " | £58 10 | .. |
| e " " Sheets | " | £74 15 | .. |
| e " " Rod | " | £63 5 | .. |
| c " " H.C. Wire | per lb. | 7¾d. | .. |
| f Ebonite Rod | " | 6/- | .. |
| f " Sheet | " | 5/6 | .. |
| n German Silver Wire | " | 1/6 | .. |
| h Gutta-percha, fine | " | .. | .. |
| h India-rubber, Para fine | " | 6/8 | 11d. dec. |
| i Iron Pig (Cleveland warrants) | per ton | 49/3 | 7½d. dec. |
| l " Wire, galv. No. 8, P.O. qual. | " | £14 | .. |
| g Lead, English Ingot | " | £13 | 5/- inc. |
| m Manganin Wire No. 28 | per lb. | 6/6 | .. |
| g Mercury | per bot. | £8 12 6 | .. |
| d Mica (in original cases) small | per lb. | 6d. to 1s. | .. |
| d " " " medium | " | 2/6 to 4/- | .. |
| d " " " large | " | 4/6 to 8/6 | .. |
| p Phosphor Bronze, plain castings | " | 11d. | .. |
| p " " rolled bars & rods | " | 1/0½ | .. |
| p " " rolled strip & sheet | " | 1/1 | .. |
| o Platinum | per oz. | 135/- to 140/- | 5/- inc. |
| e Silicium Bronze Wire | per lb. | 8½d. | .. |
| r Steel Magnet, in bars | per ton | £55 | .. |
| g Tin, Block (English) | " | £156 to £157 | .. |
| n " Wire, Nos. 1 to 16 | per lb. | 1/10 | .. |
| p White Anti-friction Metals | per ton | £45 to £150 | .. |
| k Zinc, Sh't (Vieille Montagne bnd.) | " | £28 15 | £1 5 inc. |

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

**Continental.**—Germany.—A net profit of £187,136 is shown in the balance-sheet of the Rheinisch-Westfalisches Electricitatswerk Gesellschaft, of Essen, for the last financial year, as compared with £183,878 in the preceding 12 months, a dividend at the rate of 8 per cent. being declared.

Spain.—La Sociedad Siemens-Schuckert Industrie Electrica is the name of a new company which has just been formed in Madrid, with a capital of £180,000, to develop the Siemens-Schuckert electrical business in Spain.

**Charges for Electricity.**—In view of the publication of statements in the daily Press on "Dearer Electricity," and of the remarks appearing in our "Stocks and Shares" letter to-day, we publish the following copy of a circular issued by the Metropolitan Electric Supply Co., Ltd.:—

"Notice is hereby given to those consumers who have not yet availed themselves of the company's new contract tariff, that during the quarter ending December 31st, 1910, and until further notice, electrical energy now charged at 5½d. per unit will be charged 6d. per unit. The company take this opportunity of again directing attention to the contract tariff described overleaf, which is offered as an alternative to the above charge."

## STOCKS AND SHARES.

Tuesday Evening.

With Consols at a new low-level price in their 2½ per cent. form, the investment markets have a good deal to contend with, and the rather unexpected flurry in money has shaken the equilibrium of other departments besides those given up to gilt-edged securities. The second-grade issues of foreign extraction are in most demand, and the home varieties receive scant consideration.

Electricity supply shares are soon at a standstill. The only change in the metropolitan list is $\frac{1}{16}$ decline in London Electric Preference shares.

The Metropolitan Electric Supply Company has raised the price to its private consumers from 5½d. to 6d. per unit. To the mind of the mere outsider it might seem a little to be regretted that, with the gas companies so militantly energetic at the present time, it is necessary to put up electricity prices, despite the "growing use of the current-saving metallic-filament lamp," as the announcement quoted by the *Daily Mail* puts it.

The move suggests that the Metropolitan Company may not show up well in the next half-yearly reports. It will, however, be disappointing if the City and the County of London Companies do not increase their profits for the present half-year, while the Charing Cross may be handicapped by its City undertaking. The Brompton, Notting Hill, Kensington, Chelsea and Westminster, with the St. James', should be able to give indications of having reached that point at which the metallic filament factor has reached its limit of curtailing profits. Still, even yet, the outlook is not sufficiently bright to encourage the idea that a purchaser can buy the shares with any idea except that of a lock-up investment.

The Home Railway market is mildly dull, by reason of the money and the labour outlook. Prices have so far been fairly well maintained, and the electrical issues have not changed, except for a point fall in Central London Deferred. There is not much disposition on the part of the investor to increase his interest in Home Railway stocks of any kind.

Tramway and traction descriptions are generally firm. Metropolitan Electric Tramways Ordinary rose $\frac{1}{32}$, and British Electric Traction Preference 5s., on a small demand, prompted by the remarkable improvement in other traction stocks and shares which has been a feature during the month now finishing. Anglo-Argentine Trams First Preference are $\frac{1}{16}$ better, and Calcutta Trams ½. Cape Electric Trams have rallied again to 7s. 6d.

British Columbia Electric Railway Deferred regained the three points shed last week, the prospectus now being out of the exchange proposed to the holders of the 4½ per cent. Vancouver Power Debentures, who are offered 4¼ per cent. perpetual consolidated Debenture stock, with certain advantages which the directors calculate will make the equivalent of a 5½ per cent. premium on the amount of the Debentures held by the proprietors.

In the Canadian-South American list, Mexico Trams are easier, but the first mortgage bonds are ¼ up. Rio Trams pursue their upward progress, hardening to 104½. Para Electric Tramways at 7¼ show a $\frac{5}{16}$ advance, and have been vigorously pushed, on account of the company's good earnings; the 6 per cent. Cumulative Preference are firm at 5¼, while the 5 per cent. First Debenture stands at 99, and carries interest payable in November. Canadian General Common stock has changed hands at 111½, and the 7 per cent. Preference is just under 120. Mexican Light and Power continues to be strongly supported. The Common is up to 89¾, and Mexican Electric Light 5 per cent. first mortgage gold bonds rose 1¼ to 91½.

Telegraph and Telephone stocks and shares remain good, although there are not the same number of rises to record this week, as there have been on the two preceding occasions. West India and Panama Ordinary shed $\frac{5}{32}$ after their sharp advance: otherwise the movements are all in the contrary direction. The Eastern group is very quiet, but American issues exhibit a good deal of strength. A mildly sensational jump in Mackay Companies' Common shares had taken the price to 95½, a rise of 4½ points, and the 4 per cent. Preferred at 77½ is 1½ higher. Telephones are steady, with small improvements in American Telephone and Telegraph, United River Plate shares, and Oriental 4 per cent. Debenture stock.

Dick, Kerr's slipped back to 1 on the reduced dividend and carry-forward, referred to here last week. Henley's are the best feature amongst the manufacturing shares, rises having lifted both classes of shares, and the Debenture stock as well. British Insulated at 7 have gone back a little.

**Babcock & Wilcox, Ltd.**—The directors have declared an interim dividend of 10 per cent., compared with 8 per cent. last year.

# SHARE LIST OF ELECTRICAL COMPANIES.

## TELEGRAPH AND TELEPHONE COMPANIES.

| Present Issue. | NAME. | Stock or Share. | Dividends for the last four years. 1906. | 1907. | 1908. | 1909. | Closing Quotations Sep. 20th. | Closing Quotations Sep. 27th. | Business done week ended Sep. 27th, 1910. Highest | Lowest. | Rise + or Fall — | Present Yield per cent. £ s. d. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25,000 | Amazon Telegraph Co.'s shares, Nos. 1 to 25,000 | 10 | Nil | Nil | Nil | Nil | 3⅜ — 4⅛ | 3⅜ — 4⅛ | .. | .. | .. | Nil. |
| 286,500 | Do. 5 % Deb. Red. Iss. at 98 % script all paid | Stock | 5 % | 5 % | 5 % | 5 % | 95 — 97 | 95 — 97 | .. | .. | .. | 4 17 7 |
| 255,196,000 | American Telephone & Telegraph, Cap Stock .. | $100 | 8 % | 8 % | 8 % | 8 % | 138 —141 | 139 —142 | .. | .. | +1 | 5 12 8 |
| 53,000,000 | Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000 | $1000 | 4 % | 4 % | 4 % | 4 % | 93 — 95 | 93 — 95 | .. | .. | .. | 4 4 3 |
| 558,460 | Anglo-American Telegraph .. .. .. .. | Stock | 3⅞% | 3½% | £3 4s. | 3⅜% | 67 — 69 | 67 — 69 | 67½ | .. | .. | 5 5 1 |
| 3,220,770 | Do. do. 6 % Pref. .. .. | Stock | 6 % | 6 % | 6 % | 6 % | 109 —111 | 109 —111 | 110⅜ | 109½ | .. | 5 7 2 |
| 3,220,770 | Do. do. do. Deferred .. .. | Stock | 1¾% | 1 % | 8/- | 25/- | 26⅞— 27⅛ | 26⅞— 27⅛ | 27⅛ | 26⅞ | .. | 4 12 7 |
| 47,725 | Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red. | 100 | 5 % | 5 % | 5 % | 5 % | 101 —103 | 101½—103½ | .. | .. | + ½ | 4 16 7 |
| 44,000 | Chili Telephone, Nos. 1 to 44,000 .. .. .. | 5 | 8 % | 8 % | 8 % | 8 % | 9⅛ — 10 | 9⅛ — 10 | 9⅞ | .. | .. | 4 0 0 |
| 2,449,176 | Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red. | Stock | 4 % | 4 % | 4 % | 4 % | 85 — 87 | 85⅛— 86½ | 86⅛ | 85⅞ | .. | 4 12 0 |
| 16,000 | Cuba Telegraph .. .. .. .. .. .. | 10 | 5 % | 6 % | 6 % | 6 % | 8⅞ — 9⅛ | 8⅞ — 9⅛ | 9⅞ | .. | .. | 6 6 4 |
| 6,000 | Do. 10 % Pref. .. .. .. .. | 10 | 10 % | 10 % | 10 % | 10 % | 16½— 17⅝ | 16⅝— 17⅝ | 17⅝ | .. | .. | 5 14 3 |
| 12,931 | Direct Spanish Telegraph, Ord. .. .. .. | 5 | 4 % | 4 % | 4 % | 4 % | 3⅜— 3¾ | 3⅜— 3⅝ | 73/12 | .. | .. | 5 3 3 |
| 6,000 | Do. do. 10 % Cum. Pref. .. | 5 | 10 % | 10 % | 10 % | 10 % | 8⅜— 8⅝ | 8⅜— 9⅛ | .. | .. | + ¼ | 5 8 10 |
| 30,000 | Do. do. 4½ % Debs. .. .. | 50 | 4½% | 4½% | 4½% | 4½% | 100¾—102½ | 101 —103 | .. | .. | + ⅜ | 8 14 10 |
| 60,710 | Direct United States Cable .. .. .. .. | 20 | 4⅜% | 4½% | 4½% | 4 % | 16 — 16½ | 16⅜— 16⅝ | 16½ | 15⅞ | + ⅛ | 4 15 6 |
| 36,000 | Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R. | 100 | 4½% | 4½% | 4½% | 4½% | 100 —102 | 100 —102 | .. | .. | .. | 4 8 8 |
| 4,000,000 | Eastern Telegraph, Ord. Stock .. .. .. | Stock | 7 % | 7 % | 7 % | 7 % | 133 —136 | 133 —136 | 135 | 133½ | .. | 5 2 11 |
| 2,000,000 | Do. 3½ % Pref. Stock.. .. .. | 100 | 3½% | 3½% | 3½% | 3½% | 84 — 86 | 84 — 86 | 85 | .. | .. | 4 1 5 |
| 1,896,706 | Do. 4 % Mort. Deb. Stock Red. .. | Stock | 4 % | 4 % | 4 % | 4 % | 102½—104½ | 102½—104½ | 102⅜ | .. | .. | 3 16 7 |
| 300,000 | Eastern Extension, Australasia, and China Tele. | 10 | 7 % | 7 % | 7 % | 7 % | 12⅝— 13⅛ | 12⅝— 13⅛ | 13 | 12⅜ | .. | 5 5 8 |
| 752,400 | Do. 4 % Deb. Stock.. .. .. .. | Stock | 4 % | 4 % | 4 % | 4 % | 100 —102 | 100 —102 | 100¼ | .. | .. | 3 18 5 |
| 200,000‡ | East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000 | 25 | 4 % | 4 % | 4 % | 4 % | 100 —102 | 100 —102 | .. | .. | .. | 3 18 5 |
| 181,127 | Globe Telegraph and Trust .. .. .. .. | 10 | 5½% | 5½% | 5½% | 5½% | 10⅜— 11 | 10⅜— 11 | 10⅞ | 10⅛ | .. | 5 6 6 |
| 181,127 | Do. do. 6 % Pref. .. .. .. | 10 | 6 % | 6 % | 6 % | 6 % | 13¼— 13⅝ | 13¼— 13⅝ | 13⅝ | 13⅜ | .. | 4 7 3 |
| 150,000 | Great Northern Telegraph, of Copenhagen.. .. | 10 | 20 % | 20 % | 18 % | .. | 30¼— 31½ | 30¼— 31½ | 30⅝ | .. | + ½ | 5 14 8 |
| 17,000 | Indo-European Telegraph .. .. .. .. | 25 | 13 % | 13 % | 13 % | 13 % | 53 — 55 | 53 — 55 | .. | .. | .. | 6 15 8 |
| $41,380,400 | Mackay Companies Common .. .. .. .. | $100 | 3½% | 4 % | 4 % | 4½% | 89 — 93 xd | 94 — 97 | .. | .. | +4 | 4 7 8 |
| $50,000,000 | Do. 4% Cum. Pref. .. .. .. | $100 | 4 % | 4 % | 4 % | 4 % | 74 — 78 xd | 75 — 80 | .. | .. | +1½ | 5 0 0 |
| 394,190 | Marconi's Wireless Telegraph .. .. .. | 1 | Nil | Nil | Nil | Nil | 2⅜— 2⅝ | 2⅜— 2⅝ | 18/3 | 16/3 | .. | Nil |
| 72,680 | Monte Video Telephone Co., Ltd. Ord. .. .. | 1 | 6 % | 6 % | 6 % | 6 % | 3⅜— 3⅝ | 3⅜— 3⅝ | 17/- | .. | .. | 6 4 8 |
| 96,492 | Do. do. 5 % Pref. .. .. | 1 | 5 % | 5 % | 5 % | 5 % | 3⅜— 3⅝ | 3⅜— 3⅝ | 18/6 | .. | .. | 5 3 11 |
| 2,225,000 | National Telephone, Pref. Stock .. .. .. | 100 | 6 % | 6 % | 6 % | 6 % | 104½—106 | 104½—105½ | 104⅝ | .. | — ½ | 5 13 5 |
| 3,725,000 | Do. do. Def. Stock .. .. .. | 100 | 5 % | 6 % | 6 % | 6 % | 123 —125 | 122 —124 | 123⅜ | 123½ | —1 | 4 16 9 |
| 15,000 | Do. do. 6 % Cum. 1st Pref. .. .. | 10 | 6 % | 6 % | 6 % | 6 % | 10 — 10⅜ | 10 — 10⅜ | .. | .. | .. | 5 11 8 |
| 15,000 | Do. do. 6 % Cum. 2nd Pref. .. .. | 10 | 5 % | 6 % | 6 % | 6 % | 10 — 10⅜ | 10 — 10⅜ | .. | .. | .. | 5 11 8 |
| 250,000 | Do. do. 5 % Non-cum. 3rd P., 1 to 250,000 | 5 | 5 % | 5 % | 5 % | 5 % | 5⅜— 5⅝ | 5⅜— 5⅝ | 5 13/32 | .. | .. | 4 10 11 |
| 2,000,000 | Do. do. 3½ % Deb. Stock Red. .. | Stock | 3½% | 3½% | 3½% | 3½% | 98 —100 | 98 —100 | 98½ | .. | .. | 3 10 0 |
| 1,983,593 | Do. do. 4 % Deb. Stock Red... .. | 100 | 4 % | 4 % | 4 % | 4 % | 99 —101 | 99 —101 | .. | .. | .. | 3 19 3 |
| 179,313 | Oriental Telep. and Elec. 1 to 171,504, fully paid.. | 1 | 7 % | 8 % | 8 % | 8 % | 1⅜— 1⅛ | 1⅜— 1⅛ | .. | .. | .. | 4 14 10 |
| 50,000 | Do. do. do. 6 % Cum. Pref. .. | 1 | 6 % | 6 % | 6 % | 6 % | 1⅛— 1⅜ | 1⅛— 1⅜ | .. | .. | .. | 4 7 3 |
| 195,955 | Do. do. do. 4 % Red. Deb. Stock.. | 100 | 4 % | 4 % | 4 % | 4 % | 86½— 88½ | 87 — 89 | 88 | .. | + ½ | 4 9 11 |
| 99,400 | Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000 | 100 | 4 % | 4 % | 4 % | 4 % | 98 —100 | 98 —100 | .. | .. | .. | 4 0 0 |
| 11,889 | Reuter's .. .. .. .. .. .. .. | 8 | 5 % | 5 % | 5 % | 5 % | 7⅞— 8⅛ | 7⅞— 8⅛ | .. | .. | .. | 4 17 7 |
| 145,955 | Telephone Co. of Egypt, 4½ % Deb. Red. .. .. | 100 | 4½% | 4½% | 4½% | 4½% | 99 —101 | 99 —101 | .. | .. | .. | 4 9 1 |
| 3,042 | Submarine Cables Trust.. .. .. .. .. | Cert. | 6 % | 6 % | 6 % | .. | 133 —136 | 133 —136 | .. | .. | .. | 4 8 3 |
| 120,000 | United River Plate Telephone .. .. .. .. | 5 | 8 % | 8 % | 8 % | 8 % | 7⅛— 7⅜ | 7⅛— 7⅜ | 7⅜ | 7⅛ | .. | 5 8 6 |
| 40,000 | Do. 5 % Cum. Pref., Nos. 1 to 40,000 | 5 | 5 % | 5 % | 5 % | 5 % | 5⅝— 5 7/16 | 5⅝— 5⅞ | 5 7/16 | .. | + ⅛ | 4 7 11 |
| 30,008 | W. Coast of America, 1 to 30,000 & 53,001 to 53,008 | 2½ | 2½% | 2½% | 2½% | .. | 1⅜— 1 7/16 | 1⅜— 1 7/16 | .. | .. | .. | 4 10 11 |
| 150,000 | Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel. | 100 | 4 % | 4 % | 4 % | 4 % | 98 —100 | 98 —100 | .. | .. | .. | 4 0 0 |
| 207,930 | Western Telegraph, Ltd., Nos. 1 to 207,930 .. | 10 | 7 % | 7 % | 7 % | 7 % | 13⅜— 14½ | 13⅜— 14½ | 14 | 13⅜ | .. | 4 18 3 |
| 800,000 | Do. do. 4 % Deb. Stock Red. .. | 100 | 4 % | 4 % | 4 % | 4 % | 100—102 | 100—102 | 101½ | .. | .. | 3 18 5 |
| 88,321 | West India and Panama Telegraph .. .. .. | 10 | Nil | Nil | Nil | Nil | 1⅛— 1½ | 1 1/16— 1 5/16 | 24/4½ | 20/- | — 3/32 | Nil |
| 34,563 | Do. do. 6 % Cum. 1st Pref. .. .. | 10 | 8 % | 6 % | 6 % | 6 % | 9½— 9⅝ | 9½— 9⅝ | 9⅝ | .. | .. | 6 3 1 |
| 4,669 | Do. do. 6 % Cum. 2nd Pref. .. .. | 10 | Nil | £2 6 | 15 % | 14½% | 9¼— 9⅜ | 9¼— 9⅜ | .. | .. | .. | 15 0 0 |
| 80,000‡ | Do. do. 5 % Debs., Nos. 1 to 1,800 .. | 100 | 5 % | 5 % | 5 % | 5 % | 101½—103½ | 101½—103½ | .. | .. | .. | 4 16 7 |

## ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 640,000 | Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000 | 5 | .. | .. | .. | 5 % | 4 1/16— 4¼ | 4 2/16— 4 12/16 | 95/- | 92/6 | + 1/16 | 5 3 11 |
| 500,000 | Do. 5 % 2nd Pref., 800,000 to 1,800,000 | 5 | .. | .. | .. | 5 % | 4¼— 4½ | 4¼— 4½ | .. | .. | .. | 5 11 1 |
| 4,465,674 | Do. 4 % Deb. Stock .. .. .. | Stock | .. | .. | 4 % | 4 % | 92 — 93½ | 92 — 93½ | 93⅛ | 92½ | .. | 4 5 7 |
| 382,387 | Auckland E. Trams, 5 % 1st Mort Deb. Stock .. | 100 | 5 % | 5 % | 5 % | 5 % | 103 —105 | 103 —105 | 104 | .. | .. | 4 15 3 |
| 530,000 | Babcock & Wilcox, 1 to 530,000 .. .. .. | 1 | 20 % | 20 % | 20 % | 24 % | 5⅜— 5⅝ | 5⅜— 5⅝ | 5½ | 5 7/16 | .. | 4 6 6 |
| 100,000 | Do. do. 6 % Cum. Pref., 1 to 100,000 .. | 1 | 6 % | 6 % | 6 % | 6 % | 1 7/16— 1 9/16 | 1 7/16— 1 9/16 | .. | .. | .. | 8 19 0 |
| 1,000,000 | British Aluminium 5 % Mort. Debs. Red. .. .. | 100 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 5 9 7 |
| 500,000 | British Columbia E. Rail Def. Ord. Stock .. | 100 | 6 % | 8 % | 8 % | 8 % | 140 —144 | 143 —147 | 145½ | 143½ | .. | 5 11 1 |
| 400,000 | Do. Pref. Ord. Stock .. .. .. .. | 100 | 5 % | 5 % | 6 % | 6 % | 124 —128 | 124 —128 | 125 | .. | .. | 4 13 9 |
| 400,000 | Do. 5 % Cum. Perp. Pref. Stock .. .. .. | 100 | 5 % | 5 % | 5 % | 5 % | 110 —113 | 110 —113 | 111⅜ | 110½ | .. | 4 8 6 |
| 400,000 | Do. 4½% 1st Mort. Deb., 1 to 6,250 .. .. | 40 | 4½% | 4½% | 4½% | 4½% | 102 —104 | 102 —104 | .. | .. | .. | 4 6 7 |
| 233,000 | Do. 4½ % Vancouver Power Debs., 1 to 2,200 | 100 | 4½% | 4½% | 4½% | 4½% | 100 —103 | 100 —103 | .. | .. | .. | 4 7 5 |
| 212,600 | British Electric Traction .. .. .. .. | 10 | Nil | Nil | Nil | Nil | 3/32— 1/16 | 3/32— 1/16 | 17/6 | .. | .. | Nil |
| 133,301 | Do. do. 6 % Cum. Pref. .. .. | 10 | 6 % | 3 % | 1¼% | Nil | 2⅜— 2⅝ | 2⅜— 3 | 57/6 | 53/9 | .. | Nil |
| 161,437 | Do. do. 5 % Perp. Deb. Stock .. | Stock | 5 % | 5 % | 5 % | 5 % | 89 — 93 | 89 — 93 | .. | .. | .. | 5 7 6 |
| 1,473,653 | Do. do. 4½ % 2nd Deb. Stock Red. | 100 | 4½% | 4½% | 4½% | 4½% | 70 — 75 | 70 — 75 | .. | .. | .. | 6 0 0 |
| 528,986 | British Insulated and Helsby Cables .. .. | 5 | 10 % | 10 % | 10 % | 10 % | 7 — 7⅛xd | 6⅞— 7⅛ | .. | .. | — ⅛ | 6 17 11 |
| 100,000 | Do. do. 6 % Cum. Pref. .. .. | 5 | 6 % | 6 % | 6 % | 6 % | 6 — 6⅛ | 6 — 6⅛ | 6⅛ | .. | .. | 4 12 4 |
| 500,000 | Do. do. 4½ % 1st Mort. Deb. Red... | 100 | 4½% | 4½% | 4½% | 4½% | 101 —104 | 101 —104 | .. | .. | .. | 4 6 7 |
| 201,579‡ | British Thomson-Houston 4½ % 1st Mort. Debs. .. | 100 | 4½% | 4½% | 4½% | 4½% | 99 —101 | 98 —101 | 103⅜ | 103 | .. | 4 9 1 |
| 400,000 | British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000 | 5 | Nil | Nil | Nil | Nil | 1/16— 2/16 | 1/16— 2/16 | .. | .. | .. | Nil |
| 1,316,353 | Do. do. 4 % Mort. Deb. Stock .. | 100 | 4 % | 4 % | 4 % | 4 % | 61 — 63 | 61 — 63 | .. | .. | .. | 6 7 0 |
| 50,000 | ‡Browett, Lindley & Co., Ord. .. .. .. .. | 1 | Nil | Nil | Nil | Nil | 3/32— 1/16 | 3/32— 1/16 | .. | .. | .. | Nil |
| 50,000 | Do. do. 6 % Cum. Pref. .. .. | 1 | Nil | Nil | Nil | Nil | 14/6 to 15/6 | 14/6 to 15/6 | .. | .. | .. | Nil |
| 140,976 | Brush Electrical Engineering, Ord., 1 to 105,731 .. | 2 | Nil | Nil | Nil | Nil | 0 — 1/32 | 0 — 1/32 | .. | .. | .. | Nil |
| 200,000 | Do. do. Non-cum. 6 % Pref... | 2 | Nil | Nil | Nil | Nil | 0 — 1/32 | 0 — 1/32 | .. | .. | .. | Nil |
| 125,000‡ | Do. do. 4½ % Perp. Deb. Stock .. | Stock | 4½% | 4½% | 4½% | 4½% | 37 — 42 | 37 — 42 | .. | .. | .. | 10 14 4 |
| 125,000‡ | Do. do. 4½ % Perp. 2nd Deb. Stock.. | Stock | 4½% | 4½% | 4½% | 4½% | 22 — 26 | 22 — 26 | .. | .. | .. | 17 6 3 |
| 137,610 | Calcutta Trams, 1 to 137,610 .. .. .. .. | 5 | 8 % | 6 % | 4½% | 4½% | 4⅜— 4⅞ | 4⅜— 5 | 96/3 | 95/- | + ⅛ | 4 10 0 |
| 45,304 | Do. 5 % Cum. Pref., Nos. 1 to 29,330.. | 5 | 5 % | 5 % | 5 % | 5 % | 4⅝— 5⅛ | 4⅝— 5⅛ | .. | .. | .. | 4 17 7 |
| 350,000 | Do. 4½ % 1st Deb. Stock .. .. | 100 | 4½% | 4½% | 4½% | 4½% | 96 — 99 | 96 — 99 | .. | .. | .. | 4 10 11 |
| 35,000 | Callender's Cable Construction shares .. .. | 5 | 15 % | 15 % | 15 % | 10 % | 9⅛— 9⅞ | 9⅛— 9⅞ | .. | .. | .. | 5 0 0 |
| 40,000 | Do. do. 5 % Cum. Pref. .. .. .. | 5 | 5 % | 5 % | 5 % | 5 % | 4⅝— 5⅛ | 4⅝— 5⅛ | .. | .. | .. | 4 5 9 |
| 300,000 | Do. do. 4½ % 1st Mort. Deb. Stock Red. | Stock | 4½% | 4½% | 4½% | 4½% | 103 —105 | 103 —105 | .. | .. | .. | 4 7 0 |
| 491,222 | Cape E. Trams., 1 to 491,222 .. .. .. .. | 1 | Nil | Nil | Nil | Nil | 3/32— 4/32 | 3/32— 3/16 | .. | .. | + 3/32 | Nil |
| 450,000 | Castner-Kellner Alkali, 1 to 450,000 .. .. .. | 1 | 8 % | 12 % | 12½% | 12½% | 3 1/16— 3 3/16 | 3 5/16— 3 3/16 | 64/3 | 61/9 | .. | 3 18 9 |
| 210,153 | Do. do. 4½ % 1st Mort. Deb. Stock | 100 | 4½% | 4½% | 4 % | 4½% | 104 —107 | 105 —108 | .. | .. | +1 | 4 3 4 |
| 1,890,690 | Central London Railway, Ord. Stock .. .. | Stock | 4 % | 3 % | 3½% | 3 % | 63 — 65 | 63 — 65 | .. | .. | .. | 4 12 4 |
| 554,655 | Do. do. 4 % Pref. Stock .. .. | Stock | 4 % | 4 % | 4 % | 4 % | 84 — 86 | 84 — 86 | .. | .. | .. | 4 13 0 |
| 554,655 | Do. do. Def. do. .. .. | Stock | 4 % | 2 % | 2½% | 2 % | 46 — 48 | 45 — 47 | .. | .. | —1 | 4 5 1 |
| 1,480,000 | City and South London Railway .. .. .. | Stock | 2⅜% | 2⅜% | 1½% | 1⅜% | 27⅛— 28½ | 27⅛— 28½ | 27⅝ | 27½ | .. | 6 2 10 |
| 85,000 | Crompton & Co., Nos. 1 to 85,000 .. .. .. | 8 | 5 % | 5 % | Nil | Nil | 1/4— 2/4 | 1/4— 2/4 | .. | .. | .. | Nil |
| 100,000‡ | Do. 5 % 1st Mort. Reg. Debs., 900 of £100, and 901 11,000 of £50 Red | .. | 5 % | 5 % | 5 % | 5 % | 83 — 86 | 83 — 86 | .. | .. | .. | 5 17 8 |

* Unless otherwise stated, all shares are fully paid.

‡ From Manchester Share List.

Continued on next page.

## SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

### ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

| Present Issue. | NAME. | Stock or Share. | Dividends for the last four years. 1906. | 1907. | 1908. | 1909. | Closing Quotations Sep. 20th. | Closing Quotations Sep. 27th. | Business done week ended Sep. 27th, 1910. Highest | Lowest | Rise + or Fall — | Present Yield per cent. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | * | | | | | | | | | | £ s. d. |
| 260,000 | Dick, Kerr & Co., 1 to 260,000 | 1 | 10 % | 10 % | 6 % | 5 % | 1 — 1¼ | ⅞ — 1 | .. | .. | — ¼ | 5 0 0 |
| 305,000 | Do. do. 6 % Cum. Pref., 1 to 305,000 | 1 | 6 % | 6 % | 6 % | 6 % | 1⅞ — 1 15/16 | 1 — 1⅛ | .. | .. | — 1/16 | 5 6 8 |
| 271,030 | Do. do. 4½ % Deb. Stock | 100 | 4½% | 4½% | 4½% | 4½% | 98 —101 | 98 —101 | .. | .. | .. | 4 9 1 |
| 60,000 | Dublin United Trams. (1896), 6 % Pref., 1 to 60,000 | 10 | 6 % | 6 % | 6 % | 6 % | 12⅞ — 13⅜ | 12⅞ — 13⅜ | .. | .. | — ¼ | 4 8 11 |
| 99,261 | Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261 | 5 | 4½% | 2½% | Nil | Nil | 1 5/16 — 1 7/16 | 1 5/16 — 1 7/16 | .. | .. | .. | Nil |
| 17,189 | Do. "A" shares, 01—017,189 | 5 | 4½% | 2½% | Nil | Nil | 1 — 1⅛ | 1 — 1⅛ | .. | .. | .. | Nil |
| 307,895 | Do. 4 % Deb. Stock Red. | 100 | 4 % | 4 % | 4 % | 4 % | 63 — 68 | 63 — 68 | .. | .. | .. | 5 17 8 |
| 67,720 | Do. 5 % 2nd Deb. Stock Prov. Certs. all pd. | 100 | 5 % | 5 % | 5 % | 5 % | 79 — 82 | 79 — 82 | .. | .. | .. | 6 1 11 |
| 112,100 | Electric Construction, 1 to 112,100 | 2 | Nil | Nil | Nil | Nil | ⅛ — ¼ | ⅛ — ¼ | .. | .. | .. | Nil |
| 31,390 | Do. do. 7 % Cum. Pref., 1 to 31,390 | 2 | 7 % | 7 % | 7 % | 7 % | 1⅛ — 1¼ | 1⅛ — 1¼ | .. | .. | .. | 9 6 8 |
| 25,000 | General Electric Co. (1900), 5 % Cum. Pref. | 10 | 5 % | 5 % | 5 % | 5 % | 7⅞ — 8 | 7⅞ — 8 | .. | .. | .. | 6 5 0 |
| 200,000 | Do. do. 4 % Mort. Deb. | Stock | 4 % | 4 % | 4 % | 4 % | 82 — 86 | 82 — 86 | .. | .. | .. | 4 13 0 |
| 78,000 | Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000 | 10 | 4 % | ½% | Nil | Nil | ¾ — 1 | ¾ — 1 | .. | .. | .. | Nil |
| 96,000 | Greenwood & Batley, 7 % Cum. Pref. | 10 | 7 % | 7 % | 7 % | 7 % | 10½ — 10⅝ | 10½ — 10⅝ | .. | .. | .. | 6 10 3 |
| 80,000 | Do. do. 5 % Mort. Debs. | 100 | 5 % | 5 % | 5 % | 5 % | 102 —103½ | 102 —103½ | .. | .. | .. | 4 16 10 |
| 40,000 | Henley's (W.T.), Telegraph Works, Ord. | 5 | 15 % | 15 % | 15 % | 15 % | 12½ — 12⅝ | 12½ — 13 | 12½ | .. | + ⅛ | 5 15 5 |
| 40,000 | Do. do. 4½ % Pref. | 5 | 4½% | 4½% | 4½% | 4½% | 4 15/16 — 5 1/16 | 5 — 5⅛ | 5 3/16 | .. | + 1/16 | 3 16 2 |
| 150,000 | Do. do. 4½ % Mort. Deb Stock | Stock | 4½% | 4½% | 4½% | 4½% | 106½—108½ | 107 —109 | .. | .. | + ½ | 4 2 7 |
| 50,000 | India-Rubber, Gutta-percha & Telegraph Works | 10 | 10 % | 10 % | 10 % | 10 % | 14½ — 15 | 14½ — 15 | 14⅝ | 14½ | .. | 6 13 4 |
| 37,500 | †Liverpool Overhead Railway, Ord. | 10 | Nil | ½% | Nil | Nil | 1 3/16 — 1 5/16 | 1 3/16 — 1 5/16 | .. | .. | .. | Nil |
| 10,000 | † Do. do. Pref., fully paid | 10 | 5 % | 5 % | 5 % | 5 % | 5½ — 5⅝ | 5⅝ — 6¼ | .. | .. | + ⅛ | 8 0 0 |
| 600,070 | London United Trams. (1901) 1 to 50,007 | 10 | 3 % | 3 % | Nil | .. | 1¼ — 2⅛ | 1¼ — 2⅛ | .. | .. | .. | Nil |
| 399,930 | Do. do. 60,008 to 100,000 | 10 | 3 % | 3 % | Nil | .. | 1⅛ — 2⅛ | 1¼ — 2⅛ | .. | .. | .. | Nil |
| 125,000 | Do. do. 5 % Cum. Pref., 1 to 125,000 | 10 | 5 % | 5 % | 3⅜% | .. | 2 — 2⅛ | 2 — 2⅛ | .. | .. | .. | 15 0 0 |
| 1,649,930 | Do. do. 4 % 1st Mort. Deb. Stock | 100 | 4 % | 4 % | 4 % | 4 % | 67 — 71 | 67 — 71 | 68⅜ | 68½ | .. | 5 12 8 |
| 5,782,062 | Metropolitan Consolidated | 100 | 1 % | ½% | ½% | 1 % | 37⅞ — 38¼ | 37⅞ — 38¼ | 38¼ | 37⅞ | .. | 3 5 4 |
| 2,640,914 | Do. Surplus Lands | 100 | 2⅜% | 2⅜% | 2⅜% | 2⅜% | 65 —67 | 65 — 67 | 66⅛ | 65¼ | .. | 4 2 1 |
| 8,235,000 | Do. District | 100 | Nil | Nil | Nil | Nil | 21½ — 21⅝ | 21⅛ — 21⅜ | 21⅝ | 21⅛ | .. | Nil |
| 391,337 | Metropolitan Electric Trams., Ord. | 1 | .. | .. | 4½% | 5% | ⅜ — ⅜ | ⅜ — ⅜ | 16/6 | .. | + 3/32 | 5 14 3 |
| 314,016 | Do. do. Defd. | 1 | Nil | Nil | Nil | .. | 3/32 — 5/32 | 3/32 — 5/32 | 2/- | .. | .. | Nil |
| 500,000 | Do. do. 5 % Cum. Pref. | 1 | 5 % | 5 % | 5 % | 5 % | 13/16 — 15/16 | 13/16 — 15/16 | 17/- | 16/6 | .. | 5 6 8 |
| 595,600 | Do. do. 4½ % Deb. Stock Red. | 100 | 4½% | 4½% | 4½% | 4½% | 96 — 99 | 96 — 99 | 97⅜ | 97 | .. | 4 10 11 |
| $10,823,200 | Mexico Trams Co., Common Stock | .. | .. | .. | .. | 6 % | 128½—130½ | 127⅞—129⅜ | 129 | .. | —1 | 4 12 8 |
| $9,000,000 | Do. 1st Mort. 50-year 5 % Gld. Bds. | .. | .. | .. | 5 % | 5 % | 97⅛ — 98⅛ | 97⅝ — 98⅜ | 98⅜ | 98 | + ⅛ | 5 1 3 |
| 245,500 | Potteries Electric Traction | 1 | 4 % | 4 % | Nil | .. | 3/32 — 5/32 | 3/32 — 5/32 | .. | .. | .. | .. |
| 245,500 | Do. 5 % Cum. Pref. | 1 | 5 % | 5 % | 5 % | 5 % | 3/32 — 5/32 | 3/32 — 5/32 | 11/- | .. | — 1/16 | 7 5 5 |
| 245,000 | Do. 4½ % Deb. Stock | 100 | 4½% | 4½% | 4½% | 4½% | 82 — 85 | 82 — 85 | .. | .. | .. | 5 3 6 |
| 37,350 | Telegraph Construction and Maintenance | 12 | 15 % | 17½% | 15 % | 17½% | 35½ — 37½ | 35½ — 37½ | 36 9/16 | 36 | + ⅛ | 5 12 0 |
| 140,000 | Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909 | 100 | 4 % | 4 % | 4 % | 4 % | 101 —103 | 101 — 103 | .. | .. | + ½ | 3 17 8 |
| 1,000,000 | Underground Electric Railway, 5 % Prior Lien | .. | .. | .. | 5 % | .. | 103 —104 | 103 —104 | .. | .. | .. | 4 16 2 |
| 2,800,000 | Do. do. 4½ % Bonds | .. | .. | .. | 4½% | 4½% | 92 — 94 | 92 — 94 | 93½ | 92½ | .. | 4 14 9 |
| 4,900,000 | Do. do. 6 % Income Bonds | .. | .. | .. | .. | .. | 38 — 40 | 38 — 40 | .. | .. | .. | .. |
| 66,666 | Willans & Robinson, 1 to 30,000 & 80,001 to 116,666 | 1 | Nil | 10 % | 5 % | Nil | 1/32 — 3/32 | 1/32 — 3/32 | .. | .. | .. | .. |
| 66,666 | Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666 | 5 | .. | 6 % | 6 % | 3 % | 1¼ — 1½ | 1¼ — 1½ | .. | .. | .. | 8 11 5 |
| 245,495 | Do. 4 % 1st Mort. Deb. Stock | 100 | 4 % | 4 % | 4 % | 4 % | 60 — 70 | 60 — 70 | .. | .. | .. | 5 14 4 |

### ELECTRICITY SUPPLY COMPANIES.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30,449 | Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000 | 5 | 10% | 10 % | 10 % | 10 % | 6⅞ — 7⅛ | 6⅞ — 7⅛ | .. | .. | .. | 6 15 7 |
| 9,551 | Do. do. 7 % Cum. Pref. | 5 | 7 % | 7 % | 7 % | 7 % | 6⅞ — 7⅛ | 6⅞ — 7⅛ | .. | .. | .. | 4 14 11 |
| 400,000 | Central Electric Supply 4 % Guar. Deb. Stock | 100 | 4 % | 4 % | 4 % | 4 % | 100 —103 | 100 —103 | .. | .. | .. | 3 17 8 |
| 60,000 | Charing Cross and Strand Electricity Supply | 5 | 5 % | 5 % | 5 % | 5 % | 3⅜ — 3½ | 3⅜ — 3½ | .. | .. | .. | 6 9 0 |
| 80,000 | Do. do. do. 4½ % Cum. Pref. | 5 | 4½% | 4½% | 4½% | 4½% | 4¼ — 4⅜ | 4¼ — 4⅜ | 70/- | .. | .. | 4 14 9 |
| 80,000 | Do. "City Undertaking" 4½ % Cum. Prf. | 5 | 4½% | 4½% | 4½% | 4½% | 3⅝ — 4⅛ | 3⅝ — 4⅛ | 88/9 | .. | .. | 4 17 0 |
| 445,736 | Do. do. 4 % Deb. Stock Red. | 100 | 4 % | 4 % | 4 % | 4 % | 97 — 99 | 97 — 99 | .. | .. | .. | 4 2 6 |
| 49,486 | Chelsea Electricity Supply, Ord. | 5 | 4½% | 4½% | 4½% | 4½% | 3¾ — 4 xd | 3⅞ — 4 | .. | .. | .. | 5 12 6 |
| 175,000 | Do. do. 4½ % Deb. Stock Red. | Stock | 4½% | 4½% | 4½% | 4½% | 99 —101 | 99 —101 | .. | .. | .. | 4 9 1 |
| 70,595 | City of London Elec. Lighting, Ord. 40,001—110,595 | 10 | 6 % | 6 % | 6 % | 7 % | 11⅛ — 11⅜ | 11⅛ — 11⅜ | .. | .. | .. | 6 0 5 |
| 40,000 | Do. 6 % Cum. Pref., 1 to 40,000 | 10 | 6 % | 6 % | 6 % | 6 % | 11¼ — 12¼ | 11⅛ — 12⅛ | .. | .. | .. | 4 19 0 |
| 400,000 | Do. 5 % Db. Stk. | Stock | 5 % | 5 % | 5 % | 5 % | 120 —124 | 120 —124 | .. | .. | .. | 4 0 8 |
| 800,000 | Do. 4½ % 2nd. Db. Stk. | 100 | 4½% | 4½% | 4½% | 4½% | 99½—102½ | 99½—102½ | .. | .. | .. | 4 7 10 |
| 50,000 | County of Durham Electrical Power, Ord. | 5 | 4 % | 2 % | Nil | Nil | 1½ — 2 | 1½ — 2 | .. | .. | .. | Nil |
| 50,000 | Do. do. do. 5 % Pref. | 5 | 5 % | 5 % | 5 % | 5 % | 2⅝ — 3⅛ xd | 2⅝ — 3⅛ | .. | .. | .. | 7 16 10 |
| 250,000 | Do. do. do. 5 % 1st Mtg. Deb. | Stock | .. | .. | 5 % | 5 % | 94½ — 96½ | 94½ — 96½ | .. | .. | .. | 5 3 8 |
| 40,000 | County of London Electric Lighting, Ord. 1—40,000 | 10 | 5 % | 5 % | 5 % | 5 % | 7⅝ — 7¾ | 7⅝ — 7¾ | .. | .. | .. | 6 7 0 |
| 55,000 | Do. do. 6 % Pref., 40,001—60,000 | 10 | 6 % | 6 % | 6 % | 6 % | 10½ — 11½ | 10½ — 11½ | .. | .. | .. | 5 6 8 |
| 400,000 | Do. do. 4½ % Deb. Stock | Stock | 4½% | 4½% | 4½% | 4½% | 104½—107½ | 104½—107½ | .. | .. | .. | 4 3 9 |
| 400,000 | Do. do. 4½ % 2nd. Deb. Stock | Stock | 4½% | 4½% | 4½% | 4½% | 100 —103 | 100 —103 | 101¼ | .. | .. | 4 7 5 |
| 80,000 | Edmundson's Electric Corporation, Ord. Shares | 5 | Nil | Nil | Nil | Nil | 3/32 — 5/32 | 3/32 — 5/32 | .. | .. | .. | Nil |
| 80,000 | Do. do. 6 % Cum. Pref. | 5 | 3 % | Nil | Nil | Nil | 1⅝ — 2 | 1⅝ — 2 | .. | .. | .. | Nil |
| 480,500 | Do. do. 4½ % 1st Mort. Deb. Stk. | 100 | 4½% | 4½% | 4½% | 4½% | 75 — 78 | 75 — 78 | 76 | 75¼ | .. | 5 15 5 |
| $8,150,000 | Electrical Dev. Co. of Ontario, 5%, 1st Mtg. Gold Bnds. | $500 | .. | .. | 5 % | 5 % | 82¼ — 85¼ | 82¼ — 85¼ | 84½ | 83½ | .. | 5 17 0 |
| 10,000 | Folkestone, 1 to 10,000 | 5 | 5½% | 5½% | 5½% | 5½% | 4½ — 4⅝ xd | 4½ — 4⅝ | 84/3 | .. | .. | 5 12 10 |
| 10,000 | Do. 5 % Cum. Pref., 1 to 10,000 | 5 | 5 % | 5 % | 5 % | 5 % | 4½ — 5⅛ xd | 4½ — 5⅛ | .. | .. | .. | 4 11 11 |
| 90,000 | Do. 4½ % 1st Deb. Stock | 100 | 4½% | 4½% | 4½% | 4½% | 99 —102 | 99 —102 | .. | .. | .. | 4 8 3 |
| 15,000 | Hove, 1 to 15,000 | 5 | 9 % | 8½% | 8½% | 8½% | 7 — 7¼ | 7 — 7¼ | .. | .. | .. | 5 13 4 |
| $1,376,000 | Kaministiquia Power Co., 5 % Gold Bnds. | 100 | .. | .. | 5 % | 5 % | 100½—102½ | 100½—102½ | .. | .. | .. | 4 17 7 |
| 21,000 | Kensington and Knightsbridge Electric Ord. | 5 | 10 % | 10 % | 8 % | 8 % | 6⅞ — 7¼ | 6⅞ — 7¼ | .. | .. | .. | 5 10 4 |
| 90,000 | Do. do. do. 4 % Deben. Stk. | Stock | 4 % | 4 % | 4 % | 4 % | 93 — 95 | 93 — 95 | .. | .. | .. | 4 4 3 |
| 11,000 | London Electric Supply Corporation, Limited, Ord. | 3 | 4 % | 2½% | 3 % | .. | 1⅝ — 2 | 1⅝ — 2 | .. | .. | .. | 4 8 11 |
| 70,000 | Do. do. do. 6 % Pref. | 5 | 6 % | 6 % | 6 % | .. | 4 15/16 — 5⅛ | 4⅞ — 5⅛ | 98/9 | .. | — 1/16 | 5 17 1 |
| 382,355 | Do. do. 4 % 1st Mort. Deb. Stk. Red. | Stock | 4 % | 4½% | 4 % | 4 % | 90 — 92 | 90 — 92 | 91 | .. | .. | 4 7 7 |
| 200,000 | Metropolitan Electric Supply, 1 to 100,000 | 5 | 8 % | 6½% | 5 % | 5 % | 3¼ — 3⅜ | 3¼ — 3⅜ | 68/9 | .. | .. | 7 8 2 |
| 76,121 | Do. 4½ % Cum. Pref. 1—71,106 | 5 | 4½% | 4½% | 4½% | 4½% | 4 — 4½ | 4 — 4½ | 87/6 | 85 | .. | 5 0 0 |
| 235,000 | Do. 4½ % 1st Mort. Deben. Stock | Stock | 4½% | 4½% | 4½% | 4½% | 102 —105 | 102 —105 | .. | .. | .. | 4 5 9 |
| 248,000 | Do. 3½ % Mort. Deben. Stock Redem. | Stock | 3½% | 3½% | 3½% | 3½% | 82 — 85 | 82 — 85 | .. | .. | .. | 4 2 4 |
| $6,000,000 | Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds | 100 | 5 % | 5 % | 5 % | 5 % | 89⅜ — 90⅜ | 91 — 92 | 91⅞ | 90⅝ | +1⅛ | 5 8 8 |
| 13,585,000 | Do. Light and Power Co., Ltd., Common | $100 | .. | .. | 4 % | 4 % | 87⅛ — 89¼ | 88¼ — 89¼ | 89¼ | 88⅝ | + ¼ | 4 9 11 |
| $2,400,000 | Do. do. 7% Cum. Pref. Stk. | Stock | .. | .. | 7 % | 7 % | 108 —110 | 108½—109½ | 110⅜ | 108⅝ | .. | 6 7 3 |
| 12,000,000 | Do. do. 5% 1st Mtg. Gold Bnds. | 100 | .. | .. | 5 % | 5 % | 95 — 96 | 94⅝ — 95⅜ | 95⅝ | 94⅝ | —⅜ | 5 4 9 |
| 250,000 | Midland Electric Corporation, 4½ % 1st Mort. Deb. | 100 | 4½% | 4½% | 4½% | 4½% | 95¼ — 97½ | 96 — 98 | .. | .. | + ⅜ | 4 11 10 |
| 130,491 | Newcastle-on-Tyne, 1 to 137,500 | 5 | 8 % | 8 % | 2½% | .. | 3⅞ — 4⅛ | 3⅞ — 4⅛ | 85 | .. | .. | 2 17 3 |
| 137,500 | Do. 5 % Pref., 1 to 137,500 | 5 | 5 % | 5 % | 5 % | 5 % | 4⅛ — 4¼ | 4⅛ — 4¼ | .. | .. | .. | 5 2 7 |
| 150,000 | North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500 | 100 | .. | .. | .. | 5 % | 100 —102 | 100 —102 | .. | .. | .. | 4 18 0 |
| 10,852 | Notting Hill Electric Lighting | 10 | 7½% | 7½% | 7 % | .. | 12 — 13 | 12 — 13 | .. | .. | .. | 5 7 8 |
| 20,000 | Oxford, 1 to 96 and 407 to 20,310 | 5 | 7 % | 7 % | 7 % | 7 % | 6¼ — 6⅜ xd | 6¼ — 6⅜ | .. | .. | .. | 5 3 8 |
| 119,694 | River Plate Elcty. Co. Ord. | Stock | 2½% | 6 % | 8 % | 9 % | 210—225 | 210—225 | 216 | .. | .. | 4 0 4 |
| 100,000 | Do. do. 6% Non Cum. Pref. | Stock | 6 % | 6 % | 6 % | 6 % | 105—115 | 105—115 | 105 | .. | .. | 5 4 4 |
| 200,000 | Do. do. 5% Deb. Stk. Red. | 100 | 5 % | 5 % | 5 % | 5 % | 100½—102½ | 100½—102½ | .. | .. | .. | 4 17 7 |
| 40,000 | St. James' and Pall Mall Electric Light, Ord. | 5 | 10 % | 10 % | 10 % | 10 % | 7⅜ — 8⅛ | 7⅜ — 8⅛ | .. | .. | .. | 6 1 3 |
| 20,000 | Do. do. 7 % Pref. 20,001 to 40,000 | 5 | 7 % | 7 % | 7 % | 7 % | 6⅞ — 7¼ | 6⅞ — 7¼ | .. | .. | .. | 4 16 7 |
| 150,000 | Do. do. 3½ % Deb. Stock Red. | 100 | 3½% | 3½% | 3½% | 3½% | 84 — 86 | 84 — 86 | .. | .. | .. | 4 1 5 |
| 12,000 | Smithfield Markets Electric Supply, Ord. | 5 | Nil | Nil | Nil | .. | 1⅝ — 2 | 1⅝ — 2 | .. | .. | .. | Nil |
| 65,000 | South London Electric Supply, Ord. | 4 | 3 % | 4 % | 5 % | 5 % | 2⅝ — 3 | 2⅝ — 3 | .. | .. | .. | 6 13 4 |
| 130,100 | Do. do. 5 % 1st Mort. Deb. | 100 | .. | .. | 5 % | 5 % | 99 —102 | 99 —102 | .. | .. | .. | 4 18 0 |
| 120,000 | South Met. Elec. Lt. & Power, Ord. | 1 | 2½% | 2½% | 2½% | .. | 3/32 — 5/32 | 3/32 — 5/32 | .. | .. | .. | Nil |
| 142,968 | Do. do. 7 % Pref. | 1 | 7 % | 7 % | 7 % | 7 % | 1 3/32 — 1 5/32 | 1 3/32 — 1 5/32 | .. | .. | .. | 6 16 7 |
| 224,590 | Do. do. 4½ % 1st Deb. Stk. | 100 | 4½% | 4½% | 4½% | 4½% | 98 —101 | 98 —101 | .. | .. | .. | 4 9 1 |
| 80,000 | Urban Electric Supply, Ord. | 5 | 5 % | 5 % | 5 % | .. | ⅛ — 1 | ⅛ — 1 | .. | .. | .. | 20 0 0 |
| 50,000 | Do. do. 5 % Cum. Pref. | 5 | 5 % | 5 % | 5 % | .. | 2 — 2½ | 2 — 2½ | .. | .. | .. | 10 0 0 |
| 275,000 | Do. do. 4½ % 1st Mort. Db. Stk. Red. | 100 | 4½% | 4½% | 4½% | 4½% | 79 — 81 | 79 — 81 | .. | .. | .. | 5 11 1 |
| 808,000 | Victoria Falls Power Co., Pref. Nos. 1 to 808,000 | 1 | .. | .. | 5 % | .. | 1⅛ — 1⅜ | ⅞ — 1 | .. | .. | + 1/16 | 5 14 3 |
| 100,000 | Westminster Electric Supply, Ord. | 5 | 12 % | 10 % | 10 % | 10 % | 8 — 8½ | 8 — 8½ | 8⅛ | .. | .. | 5 11 1 |
| 279 | Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905) | 5 | 4½% | 4½% | 4½% | 4½% | 5 — 5½ | 5 — 5½ | 5⅛ | .. | .. | 4 1 10 |

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

**Bank rate of Discount 3 per cent. June 9th. 1910.**

# EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1910.

The export returns for the month again show a gratifying increase; the total, £758,950, is no less than £322,023 higher than in July, but more than half of the aggregate consists of a single huge item of telegraphic cable and apparatus to Newfoundland. Even after deducting the whole of the telegraph exports, however, the balance (£320,221) again creates a record.

The imports, valued at £195,882, also show an increase, being £31,763 higher than in the previous month; and the re-exports have increased by more than £10,000. As indications of improving trade, these figures are significant.

Exports of machinery show a notable falling-off, amounting to nearly 23 per cent., and batteries are even lower in proportion, having lost over 34 per cent.; but every other item has advanced, cables and telephone apparatus in particular having done well. The boom in telegraph cable is, of course, abnormal.

Amongst the imports there is a heavy increase under the heads of electrical and electrically-driven machinery. Wires and cables have receded, but electric lamps and telegraphic or telephonic apparatus are up. The large re-exports of the latter class deserve notice.

## Registered Exports of British and Irish Electrical Goods from the United Kingdom.

| Country receiving exports and importing. | Electrical goods and appliances. | Wires and cables, rubber and other insulations. | Electric lighting fittings and accessories. | Electric lamps and parts. | Electric meters and instruments. | Electric machinery. | Electrically-driven machinery. | Batteries and accumulators. | Carbons. | Telephonic cable and apparatus and electric bells. | Telegraphic cable and apparatus. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ |
| Russia, Sweden, Norway and Denmark ... | 381 | 11,393 | 98 | 21 | 550 | 2,314 | 63 | ... | ... | 195 | 5,764 | 20,779 |
| Germany ... ... ... ... ... ... | 212 | ... | ... | 279 | 280 | 1,516 | 60 | ... | ... | 176 | 20 | 2,543 |
| Netherlands, Java and Dutch West Indies ... | 267 | 2,926 | 201 | 35 | 36 | 446 | ... | ... | ... | ... | 26 | 3,937 |
| Belgium ... ... ... ... ... ... | 85 | 1,216 | 10 | 17 | 1,129 | 1,286 | 59 | 16 | ... | 1,038 | 19 | 4,875 |
| France and French Indo-China ... ... | 1,672 | 474 | 479 | 250 | 3 | 2,507 | ... | ... | ... | ... | 148 | 5,433 |
| Portugal ... ... ... ... ... ... | 36 | 39 | 62 | ... | 3 | 684 | ... | 2 | 23 | 434 | 13 | 1,296 |
| Spain, Canary Isles and Spanish N. Africa ... | 303 | 10 | 304 | 26 | 221 | 4,274 | 2,800 | 35 | ... | 17 | 17 | 8,007 |
| Switzerland, Italy and Austria-Hungary ... | 121 | ... | 25 | ... | 1,496 | 380 | 111 | ... | ... | ... | ... | 2,133 |
| Greece, Bulgaria and Turkey ... ... ... | ... | ... | ... | 12 | ... | 279 | 20 | 2 | ... | 161 | ... | 474 |
| Channel Isles, Gibraltar and Malta ... ... | 191 | 342 | 26 | 56 | 11 | 580 | ... | ... | 13 | 2 | 77 | 1,298 |
| U.S.A. and Philippines ... ... ... ... | 203 | ... | 245 | 233 | 40 | 433 | ... | 10 | 405 | ... | 4,416 | 5,985 |
| Canada and Newfoundland ... ... ... | 277 | 1,817 | 423 | 750 | 1,027 | 2,622 | 22 | 1,334 | ... | 577 | 401,961 | 410,810 |
| British West Indies, Bermudas, British Guiana and Falkland Isles ... ... ... ... | 160 | 5,412 | 26 | 90 | ... | ... | ... | 8 | 86 | 187 | 104 | 6,073 |
| Mexico, Colombia, Bolivia and Ecuador ... | 23 | 20 | ... | ... | 75 | 25 | ... | 13 | ... | ... | 601 | 757 |
| Peru and Uruguay ... ... ... ... ... | 17 | ... | ... | 20 | ... | 1,002 | ... | 11 | ... | 88 | 1,989 | 3,127 |
| Chile ... ... ... ... ... ... ... | 163 | 386 | 17 | 42 | 11 | 4,973 | ... | 61 | ... | 19 | 409 | 6,081 |
| Brazil ... ... ... ... ... ... ... | 370 | 6,161 | 209 | 485 | 643 | 2,499 | 3,672 | 555 | 41 | 349 | 9,677 | 24,661 |
| Argentine ... ... ... ... ... ... | 2,296 | 7,271 | ... | 2,128 | 343 | 6,124 | 1,217 | 506 | 729 | 13,543 | 2,280 | 36,437 |
| Egypt, Tunis and Morocco ... ... ... | 275 | 173 | 26 | 32 | ... | 291 | ... | 101 | ... | 944 | 925 | 2,767 |
| British West Africa and St. Helena ... ... | 3 | 369 | 54 | 126 | 5 | 1,635 | ... | 21 | 33 | ... | 36 | 2,318 |
| Cape of Good Hope ... ... ... ... | 1,248 | 2,493 | 767 | 888 | 82 | 2,506 | 295 | 311 | 60 | 47 | 1,067 | 9,764 |
| Natal ... ... ... ... ... ... ... | 1,475 | 15,899 | 1,765 | 784 | 528 | 14,867 | 1,305 | 257 | ... | 341 | 104 | 37,325 |
| Rhodesia, O.R.C. and Transvaal ... ... | 1,173 | 2,132 | 403 | 789 | ... | 2,321 | 271 | 445 | 58 | 9 | ... | 7,601 |
| Zanzibar, British East Africa and Mauritius | 145 | 390 | 18 | 54 | 42 | 538 | ... | 7 | ... | 53 | 107 | 1,354 |
| Madeira, Portuguese East and West Africa ... | 79 | 972 | 70 | 54 | 37 | 1,852 | 21 | ... | ... | 27 | ... | 3,112 |
| China and Siam ... ... ... ... ... | 429 | 2,836 | 223 | 634 | 805 | 2,173 | 1,915 | 138 | ... | 80 | ... | 9,233 |
| Japan ... ... ... ... ... ... ... | 365 | 6,190 | 645 | 947 | 331 | 10,815 | 3 | 8 | 13 | 5,449 | 1,188 | 25,954 |
| India ... ... ... ... ... ... ... | 3,725 | 3,251 | 2,256 | 2,089 | 632 | 13,762 | 3,128 | 4,805 | 279 | 680 | 1,144 | 35,751 |
| Ceylon ... ... ... ... ... ... ... | 35 | 392 | 154 | 60 | 7 | 134 | 18 | 4 | ... | 225 | 30 | 1,059 |
| Straits Settlements, Federated Malay States and Fiji ... ... ... ... ... | 194 | 3,180 | 71 | 19 | 28 | 796 | 665 | 421 | 46 | 94 | 111 | 5,625 |
| Hong Kong ... ... ... ... ... | 297 | 583 | 38 | 174 | 157 | 3,477 | 146 | 30 | 10 | 185 | 55 | 5,152 |
| West Australia ... ... ... ... ... | 87 | 980 | 125 | 321 | 115 | 4,660 | ... | 11 | 50 | ... | 102 | 6,451 |
| South Australia ... ... ... ... ... | 1,000 | 307 | 364 | 104 | 9 | 1,445 | ... | 157 | ... | ... | 211 | 3,597 |
| Victoria ... ... ... ... ... ... | 338 | 5,028 | 430 | 775 | 649 | 1,030 | ... | 523 | ... | 2,979 | ... | 11,752 |
| New South Wales ... ... ... ... | 689 | 2,942 | 1,108 | 1,548 | 1,869 | 21,229 | 289 | 475 | ... | 3,493 | 2,858 | 36,500 |
| Queensland ... ... ... ... ... | 26 | 17 | 370 | 74 | ... | 334 | 42 | ... | ... | 85 | 1,872 | 2,820 |
| Tasmania ... ... ... ... ... ... | 148 | 423 | 23 | ... | 13 | 46 | ... | 18 | ... | 21 | ... | 692 |
| New Zealand ... ... ... ... ... | 382 | 1,081 | 920 | 372 | 64 | 651 | 140 | 199 | ... | 110 | 1,398 | 5,317 |
| Total, £ | 18,890 | 87,105 | 11,955 | 14,288 | 11,241 | 116,506 | 16,262 | 10,484 | 1,846 | 31,644 | 438,729 | 758,950 |

## Registered Imports into the United Kingdom of Electrical Goods from all Countries.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Russia, Sweden, Norway and Denmark ... | ... | ... | ... | 127 | 6 | 4,466 | 575 | 505 | 6 | 9,377 | 15,062 |
| Germany ... ... ... ... ... ... | 273 | 11,933 | 1,460 | 56,630 | 1,976 | 30,405 | 1,470 | 1,915 | 7,100 | 11,197 | 124,359 |
| Holland ... ... ... ... ... ... | ... | 13 | ... | 1,698 | 99 | 5 | 11 | ... | 12 | ... | 1,838 |
| Belgium ... ... ... ... ... ... | 310 | 2,168 | 10 | 10 | 256 | −1,319 | ... | 80 | 581 | 5,583 | 7,679 |
| France ... ... ... ... ... ... | 87 | 2,652 | 218 | 2,658 | 418 | 1,179 | ... | 1,186 | 2,903 | 3,471 | 14,772 |
| Switzerland ... ... ... ... ... | 2 | 566 | 34 | −112 | ... | 1,131 | ... | 40 | 15 | ... | 1,676 |
| Italy ... ... ... ... ... ... | ... | 1,517 | 26 | ... | ... | ... | ... | ... | ... | 1,832 | 3,375 |
| Austria-Hungary ... ... ... ... | ... | 120 | ... | 540 | ... | ... | ... | ... | 1,568 | 46 | 2,274 |
| United States ... ... ... ... ... | 2,474 | 692 | 391 | 623 | ... | 15,219 | 5,081 | 19 | 110 | 60 | 24,669 |
| Various sources ... ... ... ... ... | 76 | ... | ... | 25 | ... | 32 | ... | 20 | 25 | ... | 178 |
| Total, £ | 3,222 | 19,661 | 2,139 | 62,199 | 2,755 | 51,118 | 7,137 | 3,765 | 12,320 | 31,566 | 195,882 |

## Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Various countries, mainly as above ... ... | 2,449 | 1,513 | ... | 3,385 | ... | 1,964 | ... | 539 | 541 | 17,778 | 28,169 |

Total Exports: £758,950. Total Re-Exports: £28,169. Total Imports: £195,882.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

## ELECTRIC DRIVING IN TEXTILE MILLS.

By L. CROUCH.

(*Concluded from page* 486.)

The importance of the mere torsional elasticity of a shaft, in enabling oscillations to be set up by variations in the angle of twist at any given point, in accordance with the load distribution along the shaft at the moment, is shown by the following notes (see also fig. 7) :—

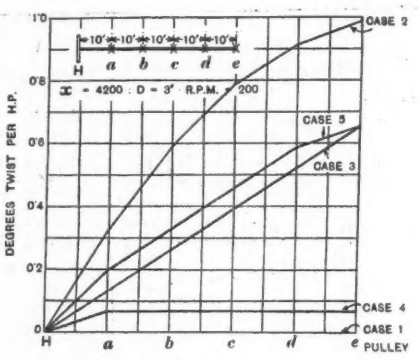


Fig. 7.

*Investigation of Shaft Twisting.*—Consider a shaft with H H.P. input ; assume $p$ pulleys equally pitched at $l$ ft. apart, and equally loaded with $h$ H.P. each (see inset diagram, fig. 7), then the twist $\theta°$ in a length $l$ of the shaft of D in. diameter (material, wrought-iron) per H.P. transmitted at, say, 200 R.P.M. is—

$$\theta° = \frac{425 \times 26{\cdot}25 \times l}{4{,}110 \times D^4} = 2{\cdot}71 \frac{l}{D^4}.$$

As a particular case, assume five pulleys 10 ft. apart, all equally loaded ; assume a 3-in. shaft running at 200 R.P.M., then the shaft twist at the various pulleys in the following cases is as shown in fig. 7 (see also Table II). The manner in which shaft oscillations are set up needs no further illustration.

Case 1.—Shafting running "light" ; no appreciable twist.
" 2.—Shafting loaded uniformly ($\frac{1}{5}$ H.P. per pulley.)
" 3.—Pulley ($e$) (fig. 7) only loaded ; load supposed double normal at ($e$) for the moment.
" 4.—Pulley ($a$) only loaded ; load normal.
" 5.—Pulleys ($a$), ($d$) and ($e$) loaded normal ; remainder running light.

TABLE II—Shaft Torsion (see fig. 7.)

| $\theta°$ at pulley. | Case (2). | Case (3). | Case (4). | Case (5). | $\theta°$ at pulley. |
|---|---|---|---|---|---|
| $a$ | 0·328 | 0·131 | 0·0656 | 0·197 | $a$ |
| $b$ | 0·591 | 0·262 | 0·0656 | 0·328 | $b$ |
| $c$ | 0·787 | 0·393 | 0·0656 | 0·459 | $c$ |
| $d$ | 0·918 | 0·525 | 0·0656 | 0·590 | $d$ |
| $e$ | 0·984 | 0·656 | 0·0656 | 0·656 | $e$ |

*Means of obtaining Speed Variations.*—It is often necessary to vary from time to time the "constant" speed at which a given textile machine is driven. Thus a frame may work on different "counts" on different days, particularly in the case of woollen mills, and a corresponding change in speed must be provided for. Again, doubling frames are usually provided with 10 per cent. possible speed variation. The first class of speed variation is met by the use of a motor direct coupled to the driven machine through a friction clutch and change gear box, or by the use of a motor direct coupled to an overhead countershaft, change speed pulleys being then used in the ordinary manner. To effect small variations in speed, rotor or armature resistance may be used, or, in D.C. machines, field resistance may be employed ; series resistance is to be avoided where possible, on account of the inefficiency involved.

A recent make of spinning frame motors provides a small cyclical variation in the driving speed, so as to compensate for the varying cop diameter, and maintain uniform tension on the yarn.

*Group or Individual Drive ?*—This again is a most important and controversial problem ; some textile machines, such as looms, ring spinning frames, counters, openers and scutchers, may well be driven individually, while others, such as mule frames, should indubitably be group driven. Quite a number of machines can be satisfactorily driven individually or collectively, according to the requirements and circumstances of each case.

Simply to replace the steam engine of a mechanically-driven mill by an electric motor would wholly sacrifice the peculiar advantages of electric driving, and would usually decrease the overall efficiency of the mill. The next stage in the sub-division of the drive is to operate each floor of the mill from a single electric motor, which may be situated centrally in the line shaft to reduce oscillations of the latter as far as possible, but which is, more generally, placed in the rope race of converted mills, or in a similar but much smaller tower in the case of new, purely electrical mills. An excellent illustration of the latter system of driving is given by the Falcon Spinning Mills, the main electrical equipment of which is as follows :—100,000 spindles : present capacity 800 KW., rising later to 1,200 KW. if desired ; alternators :—Two three-phase, 50-cycle, 500-volt machines of 460 K.V.A. at 0·87 P.F., direct driven from all-British Zoelly turbines.

An absolutely individual drive throughout a mill is bad practice, since many machines, notably mules, are far more economically treated in groups of four or eight machines. Beyond a certain point in the sub-division of the driving motors, the total H.P. of motors installed commences to rise very rapidly as compared with the total load demand, at any moment, of the plant as a whole ; further sub-division should be abandoned before this critical point is reached. Many textile machines, while requiring a small input, must be driven at comparatively low speeds, and hence necessitate large size but small H.P. motors. To reduce the installation costs per H.P. it is advisable to compromise by using fairly large driving groups, so approaching the most economical H.P. for the various line-shaft speeds which circumstances compel.

The following notes illustrate the financial aspect of the problem as to whether group or individual driving is to be preferred :—

Suppose $n$ machines requiring $h$ H.P. each have to be driven ; if the overload capacity to be provided = $k \times$ normal H.P., a total H.P. of $n\,k\,h$ must be installed. Let these machines cost £$l$ per H.P., and let their efficiency = $p$ per cent. Then total cost of motors = £$n\,k\,h\,l$, and the normal input = $\frac{n\,r\,h}{p}$ ($r$ = mean percentage of full load at which the machines as a whole operate).

Now assuming the use of a single large motor of H.P. H, H will need to be, say $(n\,k\,h)\,a$, where $a$ is a constant usually lying between 0·5 and 0·7.

The cost per H.P. of the large motor may be £L per H.P., and the efficiency P per cent., so that total cost = £$a\,n\,k\,h$.L, and input = $\frac{n\,r\,h}{P}$ H.P.

| *Summary.* | $n$ motors. | One motor. |
|---|---|---|
| Total H.P. installed ... | $1/a$ | 1·00 |
| Total cost of motors ... | $\frac{l}{a\,L}$ | 1·00 |
| Input on normal load ... | $\frac{P}{p}$ | 1·00 |

*Special Case.*—Assume that under the most unfavourable conditions $n/2$ machines start up simultaneously each requiring temporarily twice its normal H.P. ; suppose that $n/8$ machines are meanwhile stationary, the remainder operating at normal load ; then $2\,n\,h\,.\,a = \frac{1}{8}\,.\,n\,.\,h$., *i.e.*, $a = 0{\cdot}69$. Suppose that $l$ = £10 and L = £6, also that $p$ = 80 per cent. and P = 85 per cent., then adopting unit drive in place of group drive will require the installation of 1·45 × the total motor H.P. otherwise required ; the cost of installation will be 2·42 times as great, and the input on normal load will be 1·06 times as great.

Whether these less satisfactory conditions are justified by

TABLE III.—MOTOR EQUIPMENT.

| H.P. | No. of. | Type. | Speed. R.P.M. | Drive. | Load. |
|---|---|---|---|---|---|
| 200 | 1 | Ventilated, | 585 | Direct to line shaft through flexible coupling | 6 pairs mules. |
| 200 | 1 | enclosed | 580 | | Floor 1, " 2, " 3: Each motor drives 18 mules of 1,142 spindles each; 1¼ in. gauge; spindle speed, 7,000—8,000 R.P.M. |
| 200 | 1 | slip-ring | 580 | | |
| 200 | 1 | induction | 580 | | |
| 90 | 1 | Slip-ring | 365 | Flexible, direct coupled | 38 jack frames, 4 slubbing frames. |
| 90 | 1 | " " | 365 | " " " | 12 roving, 6 intermediate, 2 jack and 12 driving frames, 24 combers, 4 38-in. cards. |
| 50 | 1 | " " | 360 | " " " | 40 38-in. cards. |
| 40 | 1 | " " | 365 | " " " | 4 ribbon laps, 4 sliver laps, 26 cards, 26 combers. |
| 7 | 1 | Squirrel-cage induction | 1,410 | Belt-driven | Large opener (single). |
| 5 | 2 | | 1,410 | " " | Smaller single opener. |
| 3 | 1 | | 1,410 | " " | Fan. |

TABLE IV.

| Spindles per I.H.P. | Total No. of spindles. | No. of frames. | Mill I.H.P. | Shafting. | Mill (and engineers). |
|---|---|---|---|---|---|
| 65·0 | 107,000 (mule) | — | 1,650 | *Card room.*—220-R.P.M. 18-in. pulleys for driving, roving and intermediate frames: 170 R.P.M. for cards with 16-in. pulleys. *Mule room.*—300-R.P.M. 30-in pulleys. | Oldham (Pollitt & Wigzell) |
| 65·2 | 90,000 (mule) | 74 (self-acting) | 1,380 | *Card shaft.*—185 R.P.M.; 2½ in.—3½ in. dia.; 9 driving frames, 9 slubbing, 16 intermediate, 44 roving, of 176 spindles each. *Roving shaft.*—270 R.P.M.; 2½ in.—3½ in. dia. *Driving, intermediate and slubbing shaft.*—225 R.P.M.; 2½ in.—3½ in. dia.; drives also 27 cards. *Spinning-room shafts.*—2¾ in.—4¼ in. dia. | Blackburn (Yates & Thom) |
| 69·5 | 132,000 (mule) | — | 1,900 | (Spinning fine Egyptian yarns.) ... ... ... ... ... | Irwell Bank Mill (Bolton) |
| 35·3 | 53,000 (ring) | 140 ring frames, 376—396 spindles each. | 1,500 | Among other manufactures:—12 slubbing frames, 104 spindles each; 20 intermediate frames, 140 spindles each; 52 roving frames, 180 spindles each; 140 spinning frames, 376—396 spindles each. | Stockport (J. & E. Wood) |
| 36·2 | 36,000 (ring) | — | 995 | *Card shaft.*—175-R.P.M. 17-in. pulleys. ... ... ... ... *Driving, roving and intermediate shafts.*—254-R.P.M. 27-in. pulleys. *Spinning shafts.*—254-R.P.M. 42-in. pulleys. | Sowerby Bridge (Pollitt & Wigzell) |

the advantages of unit driving has to be determined in each case on its own merits.

In an average textile mill there are eight or nine main line shafts which, following the Falcon mill system, might each be driven by a single direct-coupled electric motor of suitable characteristics; a greater sub-division of drive would usually be permissible and advisable.

The mule, ring and blowing room shafts all require a considerable input H.P. at fairly high speed (say 350 R.P.M.) and are hence suited for driving by one motor per shaft. Carding engines, taking, say, ¾ H.P. each at 170 R.P.M., are best driven in groups, since suitable "individual" motors of such small horse-power and low speed give trouble in cleaning, cooling and keeping dry as well as being relatively costly. A typical 250-H.P. departmental motor drove 24 mules of 1,350 spindles each (shaft speed 485 R.P.M.).

The accompanying data form a suitable conclusion to this important section in that they give authoritative and representative information concerning the horse-power and shaft speeds in textile mills and concerning the individual H.P. and speed requirements of various machines.

TABLE V.

| Machine. | I.H.P. | R.P.M. | H.P./R.P.M. |
|---|---|---|---|
| Bale breaker ... ... | 2—2½ | 450—500 | ·0044—·0050 |
| Single vertical opener ... | 4 | 1,000 | ·004 |
| " scutcher ... ... | 4 | 1,000—1,200 | ·0040—·0033 |
| Carding engine ... ... | ¾ | 160—180 | ·0047—·0042 |
| 12 delivery drawing frame | 1 | 150—300 | ·0067—·0033 |
| Slubbing frame, 90 spindles | 2 | 200—300 | ·0100—·0067 |
| Intermediate " 120 " | 2 | 300—385 | ·0067—·0052 |
| Roving " 150 " | 2 | 310—455 | ·0065—·0044 |
| Jack " 200 " | 2 | 310—455 | ·0065—·0044 |
| Self-acting mules, 120-140 spindles ... ... ... | Per 1 I.H.P. | | — |
| Cop winding, 300 spindles | " 1 " | 120 | — |
| Ring frame, 90-100 " | " 1 " | | — |
| Ring doubler, 55 " | " 1 " | | — |
| Drum winder, 100 drums | " 1 " | 400—600 | — |
| 80-hank reel ... ... | ½ I.H.P. | 250 | 0·0005 |

*Individual driving* lessens the amount of belting, gearing and shafting, reduces dust and allows of better lighting and ventilation. All speed variations, breakdowns, &c., are confined to the machine in which they originate, and overtime or experimental runs are possible where and when desired and at minimum cost. On the other hand, the system is more costly to install, and requires a somewhat greater percentage of the total space to be devoted to the driving motors.

*Group Driving* in larger or smaller groups, as determined by the nature of the machines driven, is current English practice, and forms a working compromise leading to the highest efficiency attainable at moderate cost. Any speed fluctuations set up by one member of a group of machines are reflected to all the other members of the group (figs. 2—4), but this tendency is a minimum if good three-phase motors be used, and reasonably small, compact groups of machines be chosen for collective driving.

*Financial Considerations—Public Supply—Critical Cost per Unit and Mill Horse-Power for Home Generation.*—The economic advantages of electric driving, so far as concerns installation costs, are most pronounced when a new mill has to be equipped; in such a case the cost of engine, boilers, power buildings, chimney and dam, can be entirely avoided by purchasing power from a supply company; the cost of belting and ropes can in any case be reduced by 40—60 per cent. by the adoption of electric drive, the corresponding reduction in shafting cost is 60 per cent., and, owing to the lighter girders possible on account of the lighter shafting, the cost of the mill building itself may, in a new installation, be less by 10 per cent.

When purchasing energy "ready made," the capital cost of the complete electrical equipment is usually some 50 per cent. of the cost of boilers, engine and main rope-drive. The average cost of fairly small electric motors is £4 5s. per H.P.

Electrical machinery depreciates less in value and efficiency than does steam machinery.

The reductions in capital cost and the increased output obtainable by adopting electric drive result in a greater mill revenue per £1 capital sunk, and hence in improved financial stability.

In the case of a *conversion from mechanical to electrical driving* there are three conditions possible:—

1. Conversion of a modern mechanical plant to electric drive—very improbable, on account of the great cost and relatively small advantages resulting.

2. Conversion of an old mechanical equipment to electrical operation (retaining the existing steam plant for generating purposes). The capital cost is considerable; much of the millwrighting will need replacement, and a generator, set of motors, and all accessories must be provided; but the superior efficiency and other advantages accruing usually fully justify the investment.

3. Conversion of an old mechanical mill to electrical driving (the existing steam plant being too old for retention). In this case, as in the equipment of a new mill, it is often advisable to take energy from a supply company (see, however, subsequent notes).

Only the chief outlines of the problem as to whether power should be "purchased" or "generated" by the mill-owner can here be delineated. Generation of electrical energy is outside the true business of the mill-owner, and capital sunk in power plant might usually be better employed in extending the textile departments of the mill. Also, a considerable responsibility and risk of breakdown is removed by purchasing power externally; but if a suitable steam plant in good condition is already available in the mill, it is generally necessary, for financial reasons, to use this for generating purposes.

It is usual to reduce the problem to *two critical factors*: if the mill can *purchase energy below a certain cost*, and requires *less than a certain horse-power*, purchase is preferable; above these critical figures, home generation is more economical.

In determining the critical cost per unit, care must be taken to allow for *all* the costs of home generation: *e.g.*, it must be remembered that the coal bill is only some 25 to 35 per cent. of the total power cost, capital charges accounting for a further 50 per cent., and the balance being made up by depreciation, repairs, wages, water, oil and sundries. The importance of the load factor must not be neglected. Owing to the limited hours of working and intensive system of operation, the load factor of a textile mill as a whole may be 80 or 90 per cent. during working hours, and yet only 18 to 25 per cent. if reckoned over the whole year (this fact, of course, favours external power supply).

Atmospheric conditions from day to day, and even during any given day, vary the power demand very considerably.

The cost of steam power in mills varies from £3 to £5 per H.P.-year on the average (Woodhouse); the total cost of building and equipping the power house of an English textile mill (electrified) averages £35 to £65 per kilowatt.

*Critical Cost per Unit.*—If electrical energy can be purchased in bulk at from 0·3d. to 0·5d. per B.T.U., or less, such purchase should be given very favourable consideration, particularly if the mill requirements are 300—500 H.P., or less, and if no particularly efficient steam plant is already available in the mill.

*Critical Horse-Power.* — For small mills needing, say, 500 H.P. (= 17,500 ring spindles or 32,500 mule spindles), a complete electrical installation (including new engine or turbine) is more costly than a mechanical installation, but above 750 H.P. there is little difference in the prime cost of the two systems. Above, say, 500 H.P., an average well managed textile mill can lay down its own electrical plant, buildings, boiler, engines, generators and motors, with all necessary foundations, &c., pay establishment and running charges, allow 10 per cent. depreciation and interest, and rely on a total power cost of about 0·4d. per unit; under such conditions the competition between "purchased" and "generated" energy is very keen, and individual circumstances usually become the ultimate deciding factors.

*Conclusion.*—As a general summary of the above remarks, it may be taken that the chief advantages of the electrical driving of textile machinery are: (1) Some 20 per cent. diminution in breakages, owing to the smoother driving torque. (2) 10-20 per cent. increase in output per H.P., and improved quality of output (at least 5 per cent. increase in value.). (3) Superior efficiency. If the millwrighting involved by mechanical drive is straightforward, the initial efficiency is about equal to that of the equivalent electrical drive, but if many changes of direction (and hence bevels, &c.) are involved, the electrical system has the advantage from the first. Owing to the ease with which power measurements may be made and the reduced number of bearings and length of shafting, the efficiency of electrically driven mills can be *permanently maintained* at practically *maximum efficiency*, whereas a mechanical system soon deteriorates considerably and unavoidably.

Electrical driving has ready to hand the results of many years' experience of millwrighting and enables ready selection of the best. The best only must be used, and the whole plant must be kept in perfect order to reap the full benefits of electrical operation. Reciprocally, only the latter enables such maintenance to be carried out.

Electrical driving has involved several slight changes in textile millwrighting and machinery design, the most noticeable of which are: (1) The speeding-up of line shafting to suit it for direct coupling to standard electric motors. (2) The speeding-up of the machine shafts (*e.g.*, the tin roller shaft of ring doubling frames) for the same reason; this naturally involves a greater speed reduction in the machine itself, though, owing to steadier driving, a slightly greater running speed is permissible at the work if electric driving be adopted.

The finer the "count" handled and the higher the quality of the material, the greater and more desirable are such abstract advantages of electrical operation as the enhanced cleanliness due to the absence of most of the ropes and belts otherwise required, and the freedom from the dust created and stirred by the same.

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**Supply Monopolies and Contractors.**—An attempt has been made to dispel the apprehensions entertained by contractors that the grant of electric supply monopolies to manufacturing firms in Germany will also confer upon them the control of the supply of small machinery and general installation work. In the case of the central stations to be erected for the Prussian State coal mines at Saarbrucken, as was mentioned in this journal a few weeks ago, the energy is to be delivered to the A.E.G., or a subsidiary company, for distribution over a large area in the Saar region. The Royal mining authorities, in reply to allegations made as to the institution of a monopoly, state that in the agreement with the A.E.G. a monopoly of any kind in regard to installations and materials for installations which are to be connected with the proposed overland stations, has been expressly excluded. The authorities have attached the greatest value to assuring free competition for all installations to be connected, and they have taken care that this condition cannot be evaded. It goes without saying that it does not devolve upon the mining authorities to decide who has to carry out the work in individual cases, as they will solely be the suppliers of current under certain conditions. Nevertheless, the mining authorities also have great interest in seeing that a monopoly of the supply of materials and installations is not forced upon the "weak communal unions" by the A.E.G., and they have, therefore, in the agreement deprived the company of this possibility, so that even in case of the eventual readiness of a commune to grant a monopoly to the A.E.G., the latter is not allowed to accept it. On the other hand, it appears that at Schweidnitz, which is in the area of supply covered by the agreement, there already exists an electricity works erected by the A.E.G., and the Association of makers of electrical specialities recently approached the local Chamber of Commerce with a view to ascertaining what attitude this subsidiary of the A.E.G. would take up in regard to private installations. The letter was forwarded to the A.E.G. through its management at Schweidnitz, and the reply from the former admits that it is right for the Association to oppose the monopolisation of such work by undertakings having as their object the industrial supply of electricity. At the same time it is submitted that supply works have to make sure that only installations free from technical objections are connected to the mains, as defective installations endanger both consumers and supply works, whilst the selection of a uniform system of safety apparatus is also justified. Apart from these matters it is considered that the carrying out of house installations should be left to open competition, and it is mentioned that this practice is already followed in Berlin, where 700 firms of contractors exist in connection with the Berlin Electricity Works, which was the first to be established by the A.E.G.

**Diesel Engines.**—From to-morrow Messrs. Willans and Robinson, Ltd., of Rugby, are placing a line of Diesel engines on the market. During the past five years the firm have acted as manufacturers of the engine for the Diesel Engine Co., of London, but they have now made arrangements for placing the engine on the market themselves, and for dealing direct with customers, both in Great Britain and for export. Messrs. Willans and Robinson, Ltd., are manufacturing these engines in standard sizes ranging from 120 B.H.P. up to 600 B.H.P.

## THE BRITISH ASSOCIATION MEETING AT SHEFFIELD.

### Positive Electricity.

Sir J. J. Thomson presented Section "A" on Thursday, September 1st, with a continuation of the results which he gave at Winnipeg last year. He described the construction and method of use of very large discharge tubes, by the use of which simplification in the observation of positive discharges could be gained. With such tubes, together with a screen, several types of rays could be investigated. The first type were not deflected by electrostatic or magnetic forces. The second type could be deflected in either way, and were of constant voltage, not dependent upon the pressure between the terminals. The third type, which were the most interesting, were characteristic of the gas present, and they were only conspicuous at low pressures. Sir J. J. Thomson thought these rays were charged atoms, though hydrogen gave rise to rays corresponding to the molecule as well. In the case of the slower rays, the atoms could be spread out into a row of bright spots comparable with the spectrum, and he thought it probable that the application of this method of analysis to gases in vacuum tubes might give interesting results. A fourth type of rays had also been discovered.

Sir Oliver Lodge asked if the spot corresponding to the hydrogen molecule was not caused by helium, and also if the rays of the second type were positive electrons.

Sir J. J. Thomson said that there was a separate spot due to helium if present, and gave the opinion that the rays mentioned consisted of positive electrons.

### The Brighton Railway Electrification.

On Monday, September 5th, in Section "G," Mr. Philip Dawson gave an interesting lecture on the scheme for which he was responsible, whereby the London, Brighton, and South Coast Railway electrified the line from Victoria to London Bridge, known as the South London line.

About 10 years ago Mr. Dawson was called upon by the railway company to advise them as to the best means of meeting tramway competition and generally improving the prospects of that part of their line. He advised its conversion to electric traction, and, after careful consideration, decided to recommend the adoption of single-phase alternating current, transmitted through overhead wires, at a potential of 3,000 volts, whereby considerable economy in capital cost was secured. Trouble in starting up had been prophesied, but this had not been found, in spite of the fact that there was an up gradient in both directions out of every station. From Victoria the gradient was 1 in 64. On account of the certainty of being able to get a place on the train, of more comfortable waiting and more comfortable and faster travelling, the railway had succeeded in recovering all its lost traffic at double the fares of the corresponding trams; that the scheme was a thorough success was proved by the fact that the company was at the present time proceeding with the electrification of the Crystal Palace line. The first designs had been carried through practically without alteration, except in the case of the approach to Victoria Station, where the very low bridges rendered it necessary to alter the plans considerably on three occasions. The conversion had been justified in every way.

The lecture was profusely illustrated with lantern slides, and at its conclusion Prof. Silvanus Thompson, Mr. Dugald Clerk, and Mr. Charles Hawksley spoke in high commendation of Mr. Dawson's work in connection with this matter. Mr. Dawson briefly replied to their remarks.

### The Principles of Mechanical Flight.

A joint meeting of Sections A and G assembled on Monday, September 5th, to discuss matters aviational. These trifles not so light as air were responsible for a debate which took what appears to us a somewhat surprising and regrettable turn. Prof. G. H. Bryan, who opened it, did not seem at all at ease with his audience, and delivered his remarks, which were apparently written at length, in a style which would have completely failed to impress even a class of junior students. The ideas contained in his opening address were strangely mingled, and formed an extraordinary mosaic of truth and—well, not falsehood, but—mistaken notions. Pointing out, correctly and with every justification, that there is much in the subject which needs careful and thorough mathematical investigation, he went on to say that engineers did not possess the necessary ability to carry out such investigation. He said that there was work for the mathematician, the engineer, the physical experimenter, and the practical flying man. Had the necessary financial support been forthcoming, he thought that the mathematical side of the question would have been settled by now. He himself was working on it, but his duties to his students prevented him from working as much as he would wish, and indeed ought, at this subject. If arrangements could be made so that he could take a year's leave from his professional work, he might be able to put forward solutions to most of the difficulties that had occasioned so many regrettable fatalities. Mathematicians could not be expected to bear any of the blame for this, because their offers of assistance were misinterpreted as indicating a desire to trespass on the province of the engineer or the practical man. While these workers persisted in misusing mathematics as they had done in the past, it was the practical man who got killed. The same course had been taken years ago in seafaring matters. The question of the stability of ships was not properly investigated until many lives and much property had been sacrificed.

We think everyone will agree that there is work for all the departments mentioned by Prof. Bryan, but he laboured his point, as to the inability of engineers to use mathematics, to an absurd extent. In fact, in our view, there is no point about the matter at all. Some of our greatest mathematicians were engineers first. Lord Kelvin and Prof. Perry occur to one as examples.

Prof. Bryan having concluded, Sir William White spoke, defending engineers against the charge of ignorance which had been levelled at them, and deprecating strongly the division of the work into water-tight compartments, as advocated by Prof. Bryan. Was not the way in which the matter was being dealt with the best? A Commission was considering the subject on behalf of the Government, and experts of every kind, including mathematicians, were included on it.

Mr. Dugald Clerk did not disguise his emphatic disagreement with Prof. Bryan. He devoted some part of his remarks to a discussion of petrol motors, but more to the refutation of statements which Prof. Bryan had not made. Sir William White had been kind, though opposed, to Prof. Bryan. Mr. Clerk distorted what had been said, and was quite as extreme in one direction as Prof. Bryan had been in the other. Neither Mr. Clerk nor Sir William White waited for a reply to his contribution to the discussion, although Mr. Clerk's distinctly needed it. When Prof. Bryan attempted to set Mr. Clerk right, by interrupting, he was very rightly told by the President, Prof. Hobson, that he would have the opportunity of replying at the close. But Mr. Clerk walked out, after administering a few patronising pats on the shoulder to Prof. Bryan.

Prof. Petavel and Mr. Scoble contributed useful remarks; that is to say, they dealt with the subject under discussion. If the aviator would report to the engineer or mathematician as to the difficulties actually met with, much might be secured by co-operation; division into water-tight compartments was deprecated.

Mr. Worby Beaumont, in icy manner, hoped that if, on another occasion, this subject was put down for discussion, it would be discussed. Very few speakers had said much about the principles of mechanical flight. The opener of the discussion had said nothing about them. He further hoped that, in such case, the matter would be brought forward by someone capable of dealing with it properly.

In his reply, Prof. Bryan regretted that the effect of the discussion had been to accentuate instead of to reconcile the differences which existed. The meeting then adjourned for lunch—having, in our opinion, wasted its time almost entirely.

We cannot agree with Prof. Bryan in his views. He struck entirely the wrong note in opening the discussion. We were not impressed, however, by subsequent speakers, who did very little to improve matters.

Our representative met a learned professor of mathematics after the meeting was over, who was inclined to agree with Prof. Bryan that the mathematical knowledge and ability required was greater than engineers possessed. "But," he went on, "it would have been such an unpopular thing to do, to get up and defend Bryan, that no one did so." If that is true—and others expressed much the same views—we think it an extremely cowardly method of proceeding. The whole discussion was regrettable, quite useless, and disappointing to a degree.

## BRUSSELS EXHIBITION.

(*Continued from page* 494.)

The Cambridge Scientific Instrument Co., Ltd., of Cambridge, were amongst those whose exhibits were destroyed by the fire; but they have reconstituted their exhibit, though they were not able to secure so large a space as in the first instance. They showed a large variety of their well-known specialities, amongst which the Duddell oscillographs, &c., and the temperature indicating instruments were prominent.

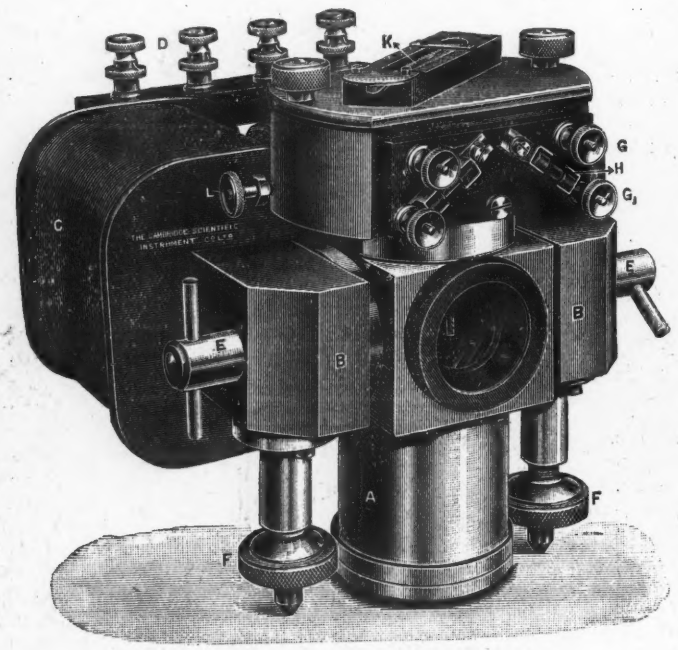


Fig 40.—Duddell Electromagnetic Oscillograph (Type 4).

The oscillograph in the hands of the company has been developed to a high degree of perfection, and is a thoroughly practical and handy instrument. It is made with either permanent or electromagnets, and both types are exhibited. The former has been illustrated in our columns; the latter is shown herewith. A more powerful field being obtainable with the electromagnet, the natural period of the vibrator can be made about 1/10,000 second, so that it is suitable for work on currents of very high frequency; the permanent magnet type has a period of about 1/3,000 second, but has the advantage of being self-contained, so that it can be insulated for use on circuits up to 50,000 volts, and it is more robust and simple than the former. Both types can be used in conjunction with a cinematograph camera, taking records up to a length of 50 metres.

The Broca galvanometer is shown—an ingenious device of the moving-magnet type, in which the suspended needles are placed vertically side by side, with consequent poles at the centre of the coils, giving a powerful and highly astatic system, with a low moment of inertia. Using coils of 110 ohms resistance, and a moving system having a period of 10 seconds, a deflection of about 1,000 mm. per micro-ampere can be obtained at 1 m. distance. The latest pattern of the Ayrton-Mather moving-coil galvanometer is also shown (fig. 41); one of the great advantages of this instrument is the ease with which the movement can be exchanged for another, the coil and suspension being completely enclosed in a dust-tight tube, as shown.

The Duddell thermo-galvanometer—an instrument which is equally correct on A.C. and D.C. circuits, and possesses practically no self-induction or capacity, being, therefore, most useful for measuring extremely weak alternating currents of high frequency such as are used in wireless telegraphy—is one of the exhibits; the suspended coil, of a single turn, carries a thermo-junction close to a minute heater through which the current to be measured passes. The same principle has been applied to portable instruments, as shown in fig. 42; the coil in this case is carried on pivots with very little friction, and is suitable for measuring currents from 0 to 10 or 0 to 100 milliamperes. Another of the Duddell instruments is the magnetic standard for calibrating ballistic galvanometers under conditions identical with those under which they are used. In this instrument the magnetic field is produced by a known current in a field coil, so that it is not dependent upon the permanence of a magnet. The coils are wound astatically to prevent interference from stray fields. The "string" electrometer, Dolezalek electrometer, &c., are shown, and a variety of pyrometers and temperature recording apparatus, both portable and fixed. Fig. 43 shows a portable thermo-electric pyrometer and millivoltmeter, the latter being of substantial construction, with pivoted moving coil.

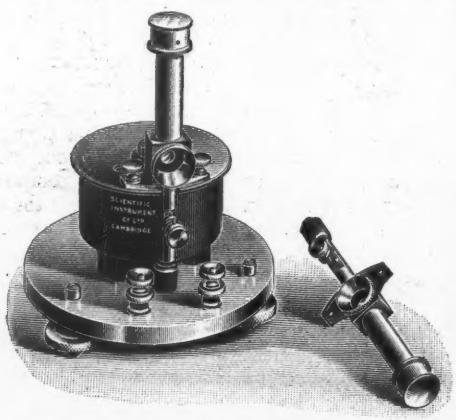

Fig. 41.—Ayrton-Mather Galvanometer.

Fig. 42.—Duddell Thermo-ammeter.

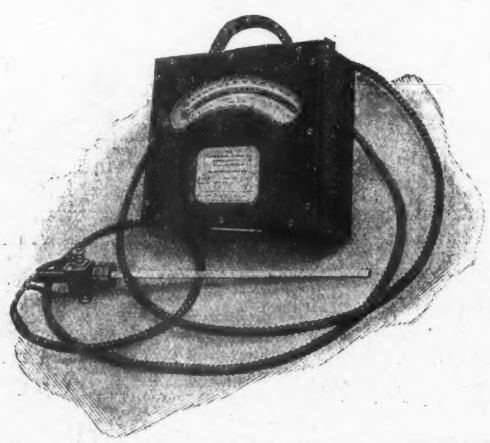

Fig. 43.—Portable Thermo-electric Pyrometer and Millivoltmeter.

The "thread recorder," resistance pyrometers, and Hohmann and Maurer industrial thermometers are other exhibits. We may refer

to the "Whipple" temperature indicator, which is portable and compact, the reading being taken by rotating a handle controlling a sliding contact until a balance is obtained, when the temperature can be read direct on a scale. The scale is arranged in spiral fashion on a drum, and is thus very open, readings being obtainable to 1° up to 2,200° F.

Messrs. Negretti & Zambra, of London, included in their exhibit three instruments recording electrically at the Exhibition; these were Lowne's patent recording anemometer, which gives a continuous record of the velocity or pressure of the wind on a chart; Lowne's patent wind vane, which operates an indicating dial, and their electrical self-recording rain gauge, which makes use of a tilting bucket acting when $\frac{1}{100}$ in. rain has fallen, and records the amount of rain on a chart. These instruments were all shown working.

Messrs. John J. Griffin & Sons, Ltd., London, showed amongst other items Tucker's high-potential primary battery, which consists of small carbon and zinc electrodes in a solution of calcium chloride, mounted in rows of 25, the liquid being retained between the electrodes by capillarity. The solution being hygroscopic never dries up, and it does not creep. The Rutherford electroscopes for measurements in radio-activity, the Boys gas calorimeter, the Mahler-Cook bomb calorimeter and various pyrometers, &c., were also shown.

*(To be continued.)*

## TRADE STATISTICS OF NEWFOUNDLAND.

The following statement of the imports of electrical and similar materials into Newfoundland is taken from the recently issued annual trade statistics for the year ended June 30th, 1909; figures for 1907-8 are added for purposes of comparison, and notes of any increases or decreases are given:—

Dollar = 4s. 2d.

| | 1907-8. Dollars. | 1909. Dollars. | Increase or decrease. Dollars. |
|---|---|---|---|
| *Belting.*— | | | |
| From United Kingdom ... | 400 | 100 | — 300 |
| „ Canada ... ... ... | 2,600 | 3,600 | + 1,000 |
| „ United States ... ... | 1,700 | 4,300 | + 2,600 |
| Total ... | 4,700 | 8,000 | + 3,300 |
| *Gutta-percha manufactures.*— | | | |
| From United Kingdom ... | 11,000 | 6,000 | — 5,000 |
| „ Canada ... ... ... | 34,000 | 36,000 | + 2,000 |
| „ United States ... ... | 38,000 | 41,000 | + 3,000 |
| „ Other countries ... | — | 1,000 | + 1,000 |
| Total ... | 83,000 | 84,000 | + 1,000 |
| *Iron and steel railway bars and fittings.*— | | | |
| From United Kingdom ... | 100 | 600 | + 500 |
| „ Canada ... ... ... | 9,000 | 18,400 | + 9,400 |
| „ United States ... ... | 1,500 | 16,000 | + 14,500 |
| Total ... | 10,600 | 35,000 | + 24,400 |
| *Locomotives and automobiles.*— | | | |
| From United Kingdom ... | 7,000 | 9,000 | + 2,000 |
| „ Canada ... ... ... | 18,000 | 10,000 | — 8,000 |
| „ United States ... ... | 21,000 | 25,000 | + 4,000 |
| Total ... | 46,000 | 44,000 | — 2,000 |
| *Radiators, electric light material, &c.*— | | | |
| From United Kingdom ... | 1,300 | 1,100 | — 200 |
| „ Canada ... ... ... | 4,300 | 2,000 | — 2,300 |
| „ United States ... ... | 12,000 | 13,600 | + 1,600 |
| „ Germany ... ... | 200 | 300 | + 100 |
| Total ... | 17,800 | 17,000 | — 800 |
| *Machinery for mining purposes.*— | | | |
| From United Kingdom ... | 79,000 | 21,000 | — 58,000 |
| „ Canada ... ... ... | 96,000 | 92,000 | — 4,000 |
| „ United States ... ... | 53,000 | 28,000 | — 25,000 |
| Total ... | 228,000 | 141,000 | — 87,000 |
| *Machinery for local industries.*— | | | |
| From United Kingdom ... | 2,000 | 5,000 | + 3,000 |
| „ Canada ... ... ... | 1,000 | 5,000 | + 4,000 |
| „ United States ... ... | 11,000 | 15,000 | + 4,000 |
| Total ... | 14,000 | 25,000 | + 11,000 |
| *Motor engines.*— | | | |
| From Canada ... ... ... | 1,000 | 1,000 | — |
| „ United States ... ... | 3,000 | 5,000 | + 2,000 |
| „ Denmark ... ... | 1,000 | 11,000 | + 10,000 |
| Total ... | 5,000 | 17,000 | + 12,000 |
| *Scientific instruments.*— | | | |
| From United Kingdom ... | 1,000 | 600 | — 400 |
| „ Canada ... ... ... | 800 | 400 | — 400 |
| „ United States ... ... | 200 | 500 | + 300 |
| Total ... | 2,000 | 1,500 | — 500 |
| *Goods for Anglo-American Telegraph Co.*— | | | |
| From United Kingdom ... | 1,600 | 600 | — 1,000 |
| „ Canada ... ... ... | 100 | 1,000 | + 900 |
| „ United States ... ... | 2,300 | 2,500 | + 200 |
| Total ... | 4,000 | 4,100 | + 100 |

**Utilisation of Water Power in Sweden.**—The official report which has just been issued by the Swedish Waterfalls Administration contains a survey of the extent of the water powers in that country and the position of the introduction of electric railway working by the use of this agency. The total water power in Sweden is estimated to amount to 10,000,000 H.P. capable of being utilised for from six to nine months in the year, and 2,500,000 H.P. which can also be used during the period of low level of the water. Out of the total quantity 75 per cent. is to be found in North Sweden, 15 per cent. in the province of Svealand, and 10 per cent. in Goetaland; and the total which will be in use in the near future will be 600,000 H.P., of which 340,000 H.P. will be for the production of electric power. At present the State is considered to own 880,000 H.P., of which 670,000 H.P. can be employed without any previous regulation of the waterfalls concerned, but the State only now utilises 63,000 H.P., of which 40,000 H.P. devolve upon the power station at the Trollhattan Falls, although work is in progress there for the use of a further 40,000 H.P. It is proposed to erect a power station of 50,000 H.P. at the Porjus Falls in North Sweden, capable of being extended to twice this power, while the State also contemplates large power stations near Akarleby, in Dalarne, and in other localities. Being exceptionally interested in the use of water power, the State has pursued a systematic waterfall policy since the adoption of the law concerning the Trollhatten Falls, although great difficulties have to be contended with owing to the antiquated laws respecting the right of disposal of water powers. It is, however, probable that a new law on modern principles will be proposed in the near future, and the Waterfalls Commission has already prepared a scheme for this purpose. The State has comprehensive projects now under consideration. Preparations are being made for the regulation of the large Wanern lake and the Siljan lake, but, above all, plans are in question for the utilisation of the water powers of the middle and southern portions of the country in connection with the electrical working of railways, and the State has acquired waterfalls in these districts for the sum of over £250,000. It is only intended to wait and see whether the electric frontier railway in the north meets expectations, in which event, it is said, the other State railways will eventually be converted to electric traction.

**A Large Electrical Crane.**—Owing to the increasing size of war vessels, it is no longer possible for them all to approach the sides of the harbour at the French naval yard at Brest. To meet the difficulty a specially large electrically-operated crane has recently been erected there by the Compagnie de Fives-Lille. The crane, which has a total lifting capacity of 150 tons, comprises a steel tower 159 ft. high, erected on a solidly-constructed masonry foundation. On the top of the tower is a circular steel track provided with a toothed crown ring. Above this is mounted horizontally a rotating arm 239 ft. long, built up of steel lattice girders. The lifting tackle is mounted at one end of the arm, while the other is employed as a counterweight, it taking the form of a large caisson filled with cement. The arm is rotated by means of a 20-H.P. three-phase electric motor, the power being sufficient to enable the arm to make a complete circle in six minutes. Although the design has been carefully worked out to ensure complete stability, safety devices have been provided. The two principal lifting carriages are arranged to slide longitudinally along the arm by means of a motor provided within them. The steel wire lifting cable is operated by a winding engine actuated by an 85-H.P. three-phase motor. The capacity of the crane is such that it will lift a load of 150 tons from a point 52 ft. away from the harbour side, or 75 tons from a point 104 ft. away; it is intended for use in connection with the installation of heavy guns, boilers and engines, &c., on the war vessels which are fitted out at the Brest Dockyard.

**Swiss Production of Nitrogen.**—It is announced that the Rhone works of the Neuhausen Aluminium Industry Co., in the Valais Canton, which have been erected for the production of nitric acid and nitrogen derivatives, and which hold out the prospect of being profitable to the undertaking, were recently completed and set in operation. The results hitherto obtained are declared fully to correspond with the original expectations.

**Radium.**—Madame Curie has announced to the Academy of Sciences the successful isolation of pure radium by electrolysis; the quantity obtained is very minute, but possesses marked properties, oxidising in air and water, and burning paper. The radiographic establishment to be called the Curie Institute is approaching completion in Paris, and will be placed under the direction of M. Curie.

## NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,140. "Improved electric coupling." D. W. JOHN and J. H. BERRY. September 12th.

21,141. "Improved electric battery lamp." D. W. JOHN and J. H. BERRY. September 12th.

21,157. "Improvements in electrodes." GILBERT ARC LAMP Co. and A. T. DOWDELL. September 12th.

21,169. "Improvements in and relating to means for supplying power to electrically-propelled vehicles." H. H. F. HYNDMAN. September 12th.

21,174. "Improvements in or pertaining to electric switches." L. J. SIDLER. September 12th. (Complete.)

21,235. "Improved motor, more especially designed for use in driving blowers, rolling mills and electric generators for smelting works." F. W. ROGLER. September 12th.

21,236. "Improvements in and relating to electric ignition devices for internal combustion engines." H. BATT. September 12th.

21,240. "Improvements in electricity meters according to the Ferraris principle." M. STRELOW. (Date applied for under Sec. 91 of the Act, September 10th, 1909, being date of application in Germany.) September 12th. (Complete.)

21,245. "Improvements in and relating to miners' electric lamps." O. OLDHAM. September 12th.

21,266. "Automatic circuit breaker." T. GAVAN. September 13th.

21,278. "Improvements relating to electrically-operated driving gear." J. A. ESSBERGER. September 13th.

21,285. "Improvements in telephone transmitters." WESTERN ELECTRIC Co., LTD. (Western Electric Co., United States.) September 13th. (Complete.)

21,291. "Means for disinfecting telephones." T. WATSON. September 13th.

21,298. "Improved internal combustion engine." E. J. WATTS. September 13th.

21,310. "Improvements in or relating to electric switches for high-tension currents." SIEMENS BROS. DYNAMO WORKS, LTD., R. A. R. BOLTON and J. C. WILLCOCKS. September 13th. (Complete.)

21,311. "Improvements in or relating to wireless telegraphy and to apparatus therefor." J. SACEK. September 13th.

21,326. "Improvements in and relating to the manufacture of metal-filament electric lamps." BERGMANN ELEKTRICITÄTS WERKE AKT. GES. (Date applied for under Sec. 91 of the Act, December 8th, 1909, being date of application in Germany.) September 13th. (Complete.)

21,328. "Telephone diaphragm." C. BAEHR. (Date applied for under Sec. 91 of the Act, March 23rd, 1910, being date of application in Germany.) September 13th. (Complete.)

21,339. "Improvements in regenerative electric motors and in means for controlling the same." JOHNSON-LUNDELL ELECTRIC TRACTION Co., LTD. (R. Lundell, United States.) September 13th. (Complete.)

21,359. "Improvements in telephonic apparatus." C. H. JOHNSON and A. S. JOHNSON. September 14th.

21,369. "Improvements in electric fire alarm." W. VOIGTLAENDER. September 14th.

21,388. "Improvements in microphone carriers for telephone apparatus." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) September 14th. (Complete.)

21,389. "Improvements in electro-medical electrode holders." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt. Ges., Germany.) September 14th. (Complete.)

21,399. "Polyphase commutator machines with more than one set of brushes for every pair of poles." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens Schuckertwerke G.m.b.H., Germany.) September 14th. (Complete.)

21,408. "Improvements in contact clips for electric wires and cables, pipes, and so forth." D. NIELD. September 14th.

21,416. "Igniter acting through a spark produced by friction." F. DIEMEL. (Date applied for under Sec. 91 of the Act, March 1st, 1910, being date of application in Germany.) September 14th. (Complete.)

21,451. "Improvements in inductive wireless telephone installations." HANS VON KRAMER. September 15th.

21,456. "Improvements in electric switch fuses." B. B. H. SUMNER. September 15th.

21,468. "Improvements in or relating to electrically-heated cooking stoves or ovens." ELECTRIC AND ORDNANCE ACCESSORIES Co., LTD. September 15th.

21,469. "Improvements relating to electric heating elements." ELECTRIC AND ORDNANCE ACCESSORIES Co., LTD. September 15th.

21,492. "Improvements in and relating to electric measuring instruments." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) September 15th. (Complete.)

21,501. "Improvements in signalling apparatus or switchboards for public houses, hotels, restaurants or the like." J. T. RICKETTS. September 15th.

21,503. "Improvements in printing telegraphs." C. K. JONES. September 15th.

21,519. "Improvements in electric incandescent lamps." A. A. WEBB and H. C. WEBB. September 16th.

21,522. "Improvements in hangers or ears for overhead electric wires or conductors." J. W. SPEIGHT and A. R. WALMSLEY. September 16th.

21,554. "Improved railway block telegraph indicator." A. T. BLACKALL and C. M. JACOBS. September 16th.

21,557. "Improved detachable heater for electrical cooking utensils and such like." J. C. C. MACDONOGH. September 16th.

21,574. "Improvements in light reflectors and means for supporting incandescent electric lamps therein." R. G. TYLER and E. H. FREEMAN, trading as Tyler & Freeman. September 16th.

21,583. "Improvements in rotary field electric transformers." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens Schuckertwerke, G.m.b.H., Germany.) September 16th. (Complete.)

21,584. "Improvements relating to dynamo-electric apparatus." H. A. MAVOR and MAVOR & COULSON, LTD. September 16th.

21,618. "Improvements in arc lamps." H. MOUL. (Korting & Mathieson Co., Ltd., Germany.) September 17th.

21,665. "Improvements in or relating to electric heating apparatus." A. F. BERRY. September 17th.

**Renold Chains at Brussels.**—Although exhibiting for the first time at an International Exhibition, MESSRS. HANS RENOLD, LTD., have gained a Grand Prix, and, in addition, have been awarded two Diplomas of Honour—higher awards in each class than those made to any other chain manufacturers.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1909.

ELECTRIC ARC LAMPS. F. W. E. Schuer. 13,728. June 11th. (Post-dated December 13th, 1909.)

DEVICE FOR AUTOMATICALLY SWITCHING ON AND OFF FLASH-SIGNS OR OTHER ELECTRIC APPARATUS AT ANY DESIRED INTERVALS. A. Brackensieck. 16,885. July 20th. (Post-dated January 17th, 1910.)

ARC LAMPS. S. C. Mount and Beck Flame Lamp, Ltd. 19,387. August 23rd.

DRIVING MECHANISM FOR USE WITH ELECTRIC MOTORS. W. G. Bambridge. 19,496. August 25th.

HOMOPOLAR GENERATORS AND MOTORS AND OTHER ELECTRICAL MACHINES HAVING A LARGE NUMBER OF COLLECTOR RINGS. R. H. Barbour. 21,179. September 16th.

SWITCHES FOR BREAKING ELECTRICAL CIRCUITS. W. C. Kirwan and K. Quaney. 21,343. September 18th.

ARRANGEMENTS FOR THE PREVENTION OF BRUSH SPARKING IN ROTARY ELECTRIC FREQUENCY TRANSFORMERS HAVING COMMUTATORS. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke Ges.) 23,291. October 12th.

REFRACTORY INSULATING MATERIALS. British Thomson-Houston Co. (General Electric Co.) 23,351. October 12th.

ELECTRIC SIGNALLING MEANS. E. A. Graham. 23,747. October 16th.

ELECTRIC PLUG AND SOCKET COUPLINGS OR CONNECTORS. N. Hosgood. 25,719. November 8th.

SWITCHING DEVICES FOR USE IN CONNECTION WITH ELECTRIC LIGHTING OR POWER. W. C. Kirwan and K. Quaney. 26,088. November 11th. (Post-dated May 11th, 1910.)

INDUCTANCE COILS FOR SUBMARINE AND OTHER ELECTRIC CABLES. Siemens Bros. & Co. and W. Dieselhorst. 26,250. November 12th.

ELECTRIC ACTIONS FOR ORGANS AND THE LIKE. C. Bamberger. 27,175. November 23rd.

SUPPORTING DEVICES FOR ELECTRIC INCANDESCENT LAMPS. R. B. Benjamin. 27,208. November 23rd.

ELECTRIC CLOCK-DRIVING DEVICES. M. Falk. 27,355. November 24th.

ELECTRIC ARC LAMP. L. M. McBride. 28,555. December 7th.

ELECTRIC IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. H. Batt. 28,818. December 9th. (Cognate application, No. 3,417 of 1910.)

STORAGE BATTERIES. H. C. Hubbell. 29,240. December 14th.

ALTERNATE-CURRENT MOTORS. R. Fynn. 30,208. December 24th.

BRUSH-HOLDERS EMPLOYED IN ELECTRICAL APPARATUS. W. A. Stevens, Ltd., W. A. Stevens and A. T. Lambert. 30,331. December 24th.

### 1910.

ELECTRICAL VAPORISER. P. Blum. 2,286. January 29th.

IGNITING DEVICES FOR GAS ENGINES AND THE LIKE. M. Briggs. 2,438. January 31st. (Date applied for under International Convention, February 4th, 1909.)

INSULATING WALL-BOXES FOR ELECTRIC APPARATUS. Z. Neudörffer. 5,835. March 8th.

ALTERNATING-CURRENT INDUCTION MOTORS. W. I. Smith, J. D. Green and A. W. Glover. 5,985. March 10th.

ELECTRIC SWITCHES. Adams Manufacturing Co. (Cutler-Hammer Mfg. Co.) 6,160. March 12th.

ELECTRIC SWITCHES. Adams Manufacturing Co. (Cutler-Hammer Mfg. Co.) 6,363. March 14th.

ELECTRIC ENERGY METERS. British Thomson-Houston Co. and D'Arcy. 6,667. March 16th. (Date applied for under Rule 13, September 20th, 1909. Request under Sec. 19 of the Act not granted.)

ELECTRIC ARC LAMPS. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke Ges.) 7,821. March 31st.

DUPLEX SYSTEMS OF ELECTRIC TELEGRAPHY. J. Kajiura. 8,141. April 4th. (Date applied for under International Convention, April 6th, 1909.)

COIN-FREED ELECTRIC ALARM-BELLS. J. Grath and H. Drexler. 8,827. April 12th.

TIME-SWITCH APPLICABLE TO ELECTRIC OR OTHER LIGHTING PURPOSES OR USES. R. Berg. 9,590. April 20th.

DEVICE FOR OPERATING MAGNETO-ELECTRIC IGNITION MACHINES. A. Zahringer. 10,820. May 2nd.

ELECTRICAL-INDUCTION SMELTING FURNACES. O. Mulacek and F. Hatlanek, 672. January 10th. (Date applied for under International Convention, March 1st, 1909.)

PORTABLE HOLDERS FOR ELECTRIC INCANDESCENT LAMPS. S. G. S. Dicker. (Benjamin Electric Manufacturing Co.) 3,977. February 17th.

DRIVING MECHANISM FOR PETROL-ELECTRIC APPARATUS. Felten & Guilleaume Lahmeyerwerke Akt.-Ges. and R. Collischonn. 4,681. February 24th. (Request under Sec. 19 of the Act not granted.)

ELECTRIC MOTOR-CONTROLLERS. Adams Manufacturing Co. (Cutler-Hammer Manufacturing Co.) 6,867. March 18th.

CONNECTIONS FOR SEMI-AUTOMATIC TELEPHONE EXCHANGES. Siemens & Halske Akt.-Ges. 6,964. March 19th. (Date applied for under International Convention, March 20th, 1909.)

SINGLE-PHASE COMMUTATOR MOTORS. Siemens Bros. Dynamo Works and F. Lydall. 7,266. March 23rd. (Application for Patent of Addition to No. 2,803 of 1908.)

SHORT-CIRCUIT DETECTORS. F. C. Reineking. 7,822. March 23rd.

TELEPHONIC TRANSMITTERS. E. A. Graham. 8,024. April 2nd.

ELECTRIC SEARCHLIGHTS. Siemens-Schuckertwerke Ges. 8,411. April 7th. (Date applied for under International Convention, April 8th, 1909. Application for Patent of Addition to No. 12,556 of 1908.)

TELEPHONE SYSTEMS. E. A. Graham. 10,577. April 29th.

ELECTRICAL WARP STOP-MOTIONS FOR LOOMS FOR WEAVING. C. Klein. 11,761. May 12th.

VARIABLE ELECTRIC TRANSFORMERS. R. A. Fessenden. 11,903. May 13th. (Date applied for under International Convention, May 18th, 1909.)

DRIVING GEAR OF DYNAMO-ELECTRIC MACHINERY FOR TRAIN LIGHTING. Akt.-Ges. Brown, Boveri et Cie. 13,502. June 3rd. (Date applied for under International Convention, June 22nd, 1909.)

**"Hoffman" Steel Balls.**—With reference to rises in prices, of which announcements have been made, we are asked to state that the prices of "Hoffman" steel balls will remain unchanged, and that no advance in their prices will take place next season; further, the Hoffman company are continually adding to the rigorous tests which the balls have to undergo at their works.